

## FINAL REPORT

<b>I</b>	<b>The Name of the Institution to be evaluated</b>	<b>National Institute of Research &amp; Development for Optoelectronics – INOE 2000</b>
<b>II</b>	<b>Evaluation Period</b>	<b>May 1<sup>st</sup> – 3<sup>rd</sup> 2012</b>
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## 1) Conclusions and recommendations (1 page):

### Conclusions

The Institute has a wide range of research fields that span from optoelectronics-based disciplines (processing, spectroscopy, metrology, etc) to environmental sciences or hydraulics engineering. The potential for cross-fertilization is very high, but this will only materialize if special efforts are devoted to encourage a higher degree of interaction between teams. Some teams feature a very competitive, internationally recognized trajectory.

The Institute employs a good number of scientists of recognized international prestige; however the scientific performance of research personnel is not uniform and some of the teams are not equally productive as far as specific research products are considered (journal papers in alternative to patents and prototype realizations). The Institute is in continuous need to attract and train young researchers at Ph.D. and postdoctoral levels to ensure continuity of some lines and to start new ones. The Institute realized a very impressive build-up of new international class research infrastructures during the last years. An unquestionable ability was demonstrated by some teams to attract and manage funds for development of new infrastructures both in Magurele and Cluj.

The Institute has acceptable age structure. Administrative volume is adequate, administrative procedures are sophisticated and well organized.

Management of the Institute is efficient with a good degree of involvement of the scientific personnel in strategic planning. The Institute plan reflects all the crucial issues for development in the coming years. The Institute has huge internal development potential tightly focused on current team activities, but it should be addressed more to external opportunities. The experience of these last four years is a very important background to be considered for the creation of new forms of participation to national and international systems for research and development, which will help in focusing the Institute mission.

### Recommendations

The Institute would benefit from a higher integration of the three territorial units. The technology transfer unit should be more actively used in identifying international patenting opportunities.

The trend observed for some teams in increased publishing in higher-impact factor journals should be encouraged and extended to all the teams.

The possibility to increase the integration of research units should be seriously considered, however caution has to be taken that merging does not damage the track record of the most competitive lines.

We invite the management to produce a more general strategic plan aiming at a real integration of different teams, with a long term human resources policy suitable to match external recruitment with possibilities of internal mobility, according to financial resources available. The strategic plan should make possible increase of integration and efficiency of some units, e.g. through technological transfer. A proper strategy for this activity should be developed. We invite to consider specific approaches to develop the number of PhD supervisors in the Institute as well.

In order to help on the brain gain and to further development of critical areas, schemes based in offering attractive temporal permanent positions to leading foreign scientists should be evaluated in compliance with available funds.

We encourage the common use of advanced instrumentation and better interconnection of the research teams. We also invite the management to address new opportunities coming from the nearby development of upscale European infrastructure (CETAL, ELI) in Romania.

The competence and the international estimation acquired in this last period should suggest a more relevant participation in the state key areas. An important emerging issue is the experience in the certification and patents that could be extended on European scale. Formation activities for technical workers should be acknowledged at national and international levels.

## 2) Observation of each evaluation team (at least 7 pages for 7 teams):

### **Team E<sub>1</sub>: Constructive and technological engineering – lasers, laser and fibre optics devices, analytical instrumentation and advanced methods for analysis**

Team leader: Dr. Gabriela PAVELESCU

The team's scientific expertise is in various fields of optoelectronics, including development and characterization of new materials for photonic applications, development of new laser and fiber optics devices for different applications. The most relevant research activity of this team is to design, realize and test opto-electronic systems for scientific and practical applications. This is done by assembling commercial (at the state of the art) components for mostly electronics and informatics, with innovative optical solutions which often include own developed products (from laser sources to fiber optics). The portfolio of scientific areas covered with activities of this team is very wide. All areas are in the intensive development and it is possible to assume that the role of optoelectronic methods, laser based technologies, laser-based or laser-added diagnostics and analytical methods will increase in many areas of human activities. Major applications relevant

to medical diagnostics and therapy have been completed with the realization of prototypes in use in Bucharest hospitals and currently on their way to commercialization. A few applications out of medical fields have been considered on projects for transportations (road surface control) and security (landmine detection). The team is involved in several national and international projects, including one FP7 project (cooperation with Estonia, Greece). Bilateral collaboration with Bulgaria, Hungary and Russia is mentioned. The research infrastructure level is fair, but it surely needs to be extended. The team has some top laboratory test facilities, including a femtosecond laser source, for photonic devices design and components characterization.

Team composition: E1 is composed of 28 researchers, 12 of them are Ph.D. and 8 are Ph.D. students. The multiple expertise, which ensures the critical mass needed for high-level scientific research in this experimental field. Among them 11 are young researchers (~35 years) which could be seen as a real preoccupation of renewal inside this team. However, a gap is observed between 35 and 45 years.

Scientific results: Researchers of this team produce high-level science, with good quantitative and qualitative output in terms of publications (87 papers during the evaluated period, from which 24 in journals with impact factor >1). High quality research products have been released up to now, including some high IF publications in medical field. A steady progression in the number of published papers during the last years is remarked and encouraged. Significant participation in international meetings (155 communications). The scattered topics covered reflect the strongly project oriented direction of the team.

Technology transfer: A constant and very important relationship with private partners is maintained. The preoccupation for technology transfer is proved by 29 patents mainly owned by the Institute, from which 5 were transferred to SMEs and 1 was sold. Two products are in fabrication at local industrial partners. The team takes care directly of its technology transfer activities, including the training of non specialized personnel (medical doctors, different sanitary operators) among the end-users. The team set up an accredited measurement laboratory "Infrastructure for characterization and diagnosis by optical and complementary methods" for external service.

PhD and scientific training: 7 PhD theses were defended during the period by the E1 members in collaboration with Romanian Universities. Extensive training mobility at international partners is noticed, without affecting the team composition.

#### Recommendations:

The team has a small subsidiary in Cluj developing some analytical instrumentation for on field use in environmental monitoring, a better integration is especially recommended for this small group, which alternatively could pass to the E4 or E5 teams which have a large consistency in Cluj. The interconnection with this subsidiary is not obvious from the visit: a better defined relationship is needed in view of possible future integration. The core team in Magurele is well organized and has a large potentiality for development in broader applicative fields, provided that the strategy does not remain focused only on the on going researches. Integration with other teams (E2 – E4) is recommended either for common scientific issues or for shared use of available characterization facilities, in particular for joint designing of specific optoelectronic sensors suitable to different applications. Diagnostic studies on the effects that innovative designs cause on the micro / nano structure of the materials in which the laser interacts is of potential interest to the other INOE teams.

We also strongly encourage this team to study the opportunity of new research directions on the future CETAI and ELL-NP facility. The team has many assets for successful technological transfer and entrepreneurial initiatives: we recommend addressing the possible creation of spin-offs or start-ups, especially in the field of medical instrumentation.

To increase international visibility, we recommend participation in organizing/chairing of international conferences of reference in the field, publishing in journals of major impact factor and membership in international journals editorial boards, and to establish bilateral cooperation in order to maintain continuity in personnel mobility.

## Team E<sub>2</sub>: New Optoelectronic Materials, Thin Films and Surface Processing by Vacuum Technologies

Team leader: Dr. V. BRAIC

This team has a long-term well-established expertise in the field of thin film deposition (by plasma, laser, sol-gel or thermal methods) and characterization, plasma surface treatment, and also (more recently) synthesis of (bulk) materials for photonics applications. This is a fully addressed material science group, where mostly films and coatings with specific optoelectronic, mechanical and thermal properties are produced. Traditional plasma reactors are available together with most innovative I-CVD system. A part from a state of the art facility for in-situ Auger analysis, the team own a very complete and impressive modern characterization laboratory, which comprises all needed instrumentation for morphological and compositional analysis, as well as for some functional tests (opto-electronic properties). The group is very well structured, with multiple expertise and obvious human resources dynamics. An extraordinarily impressive build-up of new high-quality research infrastructure has been performed during the last years. In particular the characterization laboratory has been equipped with the clear aim to make available closely to the production chain all the techniques needed to support a fast product optimization in terms of the pursued properties. Some products are developed upon direct industrial or medical (coating for prosthesis) requests, in these cases a deep fundamental investigation with modelling (at the moment not available) might be useful to specifically optimize the product performances.

Team composition: The group is composed of 21 members 11 of them hold Ph.D. degree, 1 is engineer and 6 technicians, 4 Ph.D. students and 1 master student. 1 Ph.D. degree was obtained in USA and 1 in France. Their multiple expertises ensure the critical mass needed for high-level scientific research in this experimental field. The age composition is well balanced (~45 years mean age), with very good dynamics in terms of attracting high-value young people (two of the team members obtained their PhD at recognized foreign Universities).

Scientific output: Very good quantitative and qualitative publication rate (average of ~20 papers/year, some of them in high-impact factor journals). The sustained effort developed during the last years in publishing in international higher-impact factor journals is very appreciable. The team has showed an increased quality in publication, with higher IF journals, since new equipment has been installed. Most of the papers are published in collaboration with partners from Romanian institutes or from abroad. The group has excellent international visibility: a member of the group chaired one symposium of EMRS (reference conference in the materials field), group members were involved in scientific committees and presented invited talks at various international conferences and are constantly performing peer-reviewing for highly-ranked journals. Very dynamic participation in European Networks also proves the excellent international visibility of this group.

PhD and scientific training: 3 PhD and 4 MSc theses have been defended by members of the group, from which two within international collaborations. Two PhD theses are in progress. Extensive training activity dedicated to young researchers (workshops, hands-on training) has been organized by the group.

Technology transfer: This group has a long tradition in technology transfer and very close relations with industry. Some of the applicative results were patented (7 registered, 13 applied for during the period), and others have been listed as technical expertise for consulting or services to private companies. There are no direct entrepreneurial activities, but there is a rich cooperation with interested companies. Some of these companies are partners in national or international projects. During our visit, two companies were present in the group for the development of new products. The Team is aware of the importance of process simulation methods to reinforce the laboratory results transferability to industry.

Recommendations: We strongly encourage entrepreneurial activities (creation of start-ups, spin-offs etc.). The opportunity offered by CETAL & ELI for innovative research directions (e.g. coatings for high-intensity laser beam-lines) should be addressed. In general a larger participation to international collaborations for the application of laser methods to innovative materials for future industrial applications (such as hydroxyapatite, more or less functionalized, borides, quasi-crystals, etc...) is advisable.

Most innovative instrumentation for deposition and all instrumentation for characterization is pretty new, nevertheless technical support (at the moment well balanced) might become an issue with the aging of the equipment, and should be taken into account in planning human resources renewal.

Quite surprisingly, the team has only a very modest interaction with the others as far as precursors synthesis is concerned, to this respect the interaction with the analytical laboratories in Cluj for the realization of laser sputtering targets is remarkable, although it should be better integrated with structural and physico-chemical investigations. The team has only a little impact in the development of sensors for integrated optoelectronic devices. Stronger interaction with other INOE teams is suggested for a more complete exploitation of available technologies.

We encourage the development of simulation methods to better fill the gap laboratory-industry.

## **Team E<sub>3</sub>: Optoelectronic methods and techniques for cultural heritage restoration/ conservation**

Team leader: Dr. Roxana RADVAN

The main activity of the group is related to the development and implementation of advanced optoelectronic techniques for monitoring and investigation of cultural heritage. The team is highly focused on non invasive or micro-destructive techniques to support cultural heritage restoration, ranging from different laser diagnostics and model archiving to laser cleaning. The importance of this activity is undisputed, the restoration techniques will continuously improve and many of them will be based on application of optoelectronic methods.

A very impressive effort for the development of a completely new high-quality research infrastructure (including mobile laboratory) has been performed during the last years. The group became the national reference point in the field of optoelectronic techniques for cultural heritage restoration and preservation and was certified as Centre of Excellence at the national level. The team is very active in the European panorama on the topics, not only acquiring top level instrumentations (hyperspectral camera, 3 laser scanners) but also designing and realizing own prototypes suitable for use in field campaigns from a mobile laboratory to the purpose equipped. The team already demonstrated to coordination abilities in joint on-site laboratory for cultural heritage characterization at European level. Laboratory tests aimed to optimize technology and to create needed reference data base are carried on with the help of restores suggesting and often supplying materials for phantoms and presenting specific problems requiring non invasive diagnostics. The needs for support from cultural heritage specialists are so highly felt by the team that the mobile laboratory is equipped with a data transfer system and software for partial remote operation with real time data release.

Team composition: The group is composed of only 6 research members, which is far from the critical mass when considering the high workload they face. Recent efforts to increase the group dimension (two published open permanent positions) have been made. The average age of the research group is around 33 years, with only one confirmed scientist. A critical issue for this team is the few human resources available, in spite of the advantage of their young age.

Scientific output: The scientific output of the group is not qualitatively entirely satisfactory (21 papers, almost all of them in low impact factor Romanian journals, but 6 books). On the other hand, the group leader has good international visibility (organizer of LACONA VIII conference, member of international steering committees, co-promotor of COST actions) and is actively involved in international collaborations (e.g. development of the first on-line platform with partners from Bulgaria, Spain and Italy). The team is well known for his dissemination abilities at the European level.

PhD and scientific training: 4 PhD and 5 MSc theses have been prepared in the group during the evaluated period. Extensive training activity dedicated to young researchers (workshops, hands-on training) has been organized by the group. A significant incoming mobility of foreign young researchers from EU and non-EU countries for on-site training is very appreciable. E-infrastructure offers service for educations, training and professional platform of communication at early stage of research.

Technology transfer: The team has 11 national patents, 1 was awarded a gold medal at Eureka – Innova in Belgium, 2 were awarded silver medals at International Exhibition of Inventions of Geneva in Switzerland. The team developed many transferable technologies, e.g. long-term and real-time microclimate and air quality monitoring in historical buildings and galleries, laser cleaning for movable and immovable artworks and other. It offers innovative services through mobile laboratory. The team performs regular training on innovative technologies for cultural heritage operators which should be better acknowledged, at least within a funded national formation project.

### Recommendations:

The group has a huge potential, but with a few major weaknesses to overcome:

1. The scientific output quality is very low on international standards. The group should limit publication in Romanian journals and seek access to well-recognized international journals. The maturity of the technological advances places the team at a high level, nationally and internationally.
2. The critical mass is not reached. We strongly recommend support from the management to increase the number of scientists employed in this group.
3. We also recommend the development of sustained efforts towards technology transfer and entrepreneurial activities, as the group has many opportunities in this direction.
4. The E<sub>3</sub> team should be the nucleus of an excellence center for the study of methods for preserving the artistic heritage in the country with the validation of new products for the architectural restoration that in recent times are invading the international markets.

## **Team E4: Advanced optoelectronics and complementary techniques of assessment and rehabilitation of the environment**

Team leader: Dr. Doina NICOLAE

This is a very dynamic group in the field of environmental remote sensing using optoelectronic and complementary techniques. Team E4 at Magurele is a top European group for atmospheric monitoring both in terms of pollution from particulate (back scattering and depolarization at different wavelengths) and ozone (dial techniques). Some water monitoring through fluorosensor lidar is also carried on. Concerning atmospheric lidar they design, realize and operate, their own prototype systems and can supply (as they did already in one case shown) this kind of complex opto-electronic machines to the respective end-user (e.g. meteo and aviation control authorities). They are developing as well their own data processing algorithms and can release results upon demand of specific formats (maps, matrices, threshold overcome, etc). The team is highly interdisciplinary with knowledges ranging from atmospheric chemistry and physics, to informatics and mathematics, the latter for modelling algorithms, and to optical and electronic engineering, too. The team is part of the Romanian and European networks for the specific activity. During the last years the team built a very impressive research infrastructure (including a mobile laboratory and a completely equipped new building at modern international standards). They run permanent monitoring systems operated in the networks and a mobile laboratory for on site campaigns either on atmosphere or on waters. The team offers services to all end-user interested in their environmental monitoring data, including the recalibration of satellite images and satellite lidar systems. Preprocessed real time data can be supplied to end-users interested in decision making (e.g. stop air traffic for volcanic powder presence, stop urban traffic for excessive particulate pollution). The group developed also a very important relationship network with international partners. The group is the founder of this activity in Romania and is also very successful in establishing a national network of measuring sites.

Team composition: The group is composed of 17 researchers with multiple expertises, which insures the critical mass needed for high-level scientific research and for efficient technology transfer, also in the case of supplying technology services upon request (Meteo data and atmospheric column composition to end users). Most of the researchers are young, which offers good perspectives for sustained activity in this field. A researcher has been attracted back from abroad after PhD. The group, as well as the entire structure are new, but are already a landmark for the country. The 17 young scientists who work there are getting specific skills and it is desirable they could form the permanent core of the first center of excellence in environment monitoring.

Scientific output: The scientific output of the group is quite poor qualitatively (most of the papers are published in low impact factor Romanian journals). On the other hand, the group has good international visibility and is actively involved in international collaborations and networks. Visibility gained also through participation to scientific fairs and exhibitions.

PhD and scientific training: 6 PhD and 4 MSc theses have been prepared in the group during the evaluated period. Extensive training activity dedicated to young researchers (workshops, hands-on training) has been organized by the group. A very appreciable dissemination activity at European level and national level, the latter dedicated to children and young people are developed.

Technology transfer: 3 patents during the period: environmental equipment for quality control and application, an aerosol LIDAR which are of particular relevance in the field and place Romania among the major European countries for the control of the environment. The entrepreneurial initiative spirit of the team is expressed in the development of three certified measurement laboratories, in offering qualifies scientific services, in standardization and education.

Recommendations: The team has huge potential and excellent perspectives, but has to increase the scientific output quality by publishing in well-recognized international journals. The maturity of the technological advances places the team at a high level, nationally and internationally.

One part of the E4 team is in Cluj and is dedicated mostly to water and soil in situ analyses. This subsidiary, although well equipped, does not appear integrated with the other: specific projects for soil contamination are carried on independently. Intercalibration, although possible are not yet pursued or planned. The interconnection between the research units in Magurele and Cluj is not obvious, despite the important presentation effort made. We recommend increased integration of these two units, given the common aims at environmental monitoring and the complementary instrumentation available.

The involvement in activities in the field of cultural heritage with team E3 is foreseen for the analysis of the micro-climate and storage conditions in outdoor environments or in museum exhibitions. The interaction with the team E6 is necessary because all the systems of handling large size instrumentation, either in fixed or mobile laboratories, require the realization and use of complex hydraulic structures. We also recommend development of sustained efforts towards technology transfer and entrepreneurial activities, as the group has many opportunities in this direction.

## **Team E<sub>5</sub>: Alternative fuel technologies and the science of environmental impacts and mitigation that are related with energy conversion processes**

Team leader: Dr. Cecilia Roman

The research topic of this team differs from the main stream of the INOE research. The main research areas of the team can be divided in two areas: a) biofuels obtaining and b) green energy obtaining. The biofuel development team started from former experiences on environmental issues in Cluj. The researches are inspired by the needs of the territory on medium scale, the team is not considering generic fundamental topics on the possibilities of renewable energy creation, but try to use the national resources, such as wood, agricultural products, and biomass, wind or micro hydropower generation plants. Non-standard techniques for the production of green energy have been designed and evaluated for their application on the territory.

The team develops original chemical processes in biofuel synthesis, having realized a pilot production plant for biodiesel and several different laboratory installations for bio-ethanol. They are equipped with machines for biofuel characterization which are almost unique in Romania. The machines allow determining the cetane and octane number for biodiesel and bioethanol, respectively, these parameters being used to characterize the fuel in terms of combustion effectiveness inside the engine. The testing and certification of bio-fuel quality is provided by CABIO laboratory. This laboratory tests the different petroleum-ethanol mixtures as products for domestic fuel companies through the measurement of the octane number. The team show a large concern for all side environmental aspects related to the biofuel utilization, ranging from possible alteration of biodiversity to possible consequences in greenhouse effect for climate changes.

Team composition: The staff consists of 19 researchers, 7 of them are Ph.D. The mean age is approximately 43 years. This number, coupled with the high age, seems to be quite small for the potentiality of all the diverse activities undertaken, and does not ensure a continuity of decisions taken in individual sectors.

Scientific output: It is currently modest (33 papers mostly on Romanian and non ISI journals and some conference proceedings), given the early stage of some research activities. However a positive trend is noticed with paper in press on highly qualified journals. Publishing in this field is, in comparison with optoelectronics and material science, more complicated (also due to patent protections), but it is necessary to pay attention to scientific output quality. On the other hand the team participates in several international and national networks and databases, which ensure a good national and international visibility.

PhD and scientific training: During the period 3 Ph.D. theses were elaborated or are under preparation. There are also specific training programs for MSc. and Ph.D. students and workshops for young scientists organized by this team. From collaborations with neighbouring universities in Cluj, the team shares experiences and students through the preparation of theses and lectures.

Technology transfer: The team has 7 national patents, 5 installations for biofuels obtaining were realized, 17 technologies for biofuels obtaining and 4 technologies in the area of green technologies were developed. The team is also involved in innovative and training service in the field of national biogas standards proposals, biodiesel testing and similar areas. The centre defines its activity as an "innovative services" doing their own research applied to the solution of problems related to the creation of energy by suggesting the best value / cost product. Many service activities are based on energy production for local use, by supporting the economy of small businesses active in the vicinity. The entrepreneurial initiative spirit of the team is mainly expressed in innovative services like bio-fuel quality certification, techniques validation and in education.

Recommendations: The instrumentation, largely designed in laboratory, operates on extremely small quantities, an extrapolation of the problems on such as industrial-scale bioethanol storage is recommended. Some environmental aspects could be investigated planning joint experiments with the E4 team, and more in general with the support of the analytical facilities in Cluj. The team has a good Romanian positioning and excellent local perspectives of development, a larger internalization would be advisable. Some additional research aspects are also present, along with a new line for food quality determination carried on in cooperation with local agricultural faculties.

Among the methods for creating green energy more space should be given to photovoltaic systems, where the team performs consulting activity for the construction of domestic plants, in particular for solar panels assembling. On this subject collaborations with organizations such as the European CETOP, with FLUIDAS (team E6) have been activated. Although the group Hydrotronics and Tribology cooperates in the same international association (CETOP and FLUIDAS), no joint publications have been produced yet. The numbers of researchers seems to be quite small for the potentiality of all the diverse activities undertaken. In spite of the continuous exchange between seniors, PhDs and external personnel, internal staff seems not enough to ensure a continuity of decisions taken in individual sectors.

## **Team E<sub>6</sub>: Hydrotronics and tribology - elements for increasing the functional performances of the complex automation systems**

Team leader, Dr. Petrin Drumea

The research topic of this team, similarly like research topic of the team E5, differs from the main stream of the INOE research. The research of this team is directed toward to the following main areas: equipment and systems for irrigation and environment preservation; mechatronic components based on fluidic elements, sensors, transducers and electronics assembly; auxiliary equipment and fluids conditioning systems; equipment and drive systems and hydraulic and pneumatic operations. This is a team performing exclusively industrial research, often on single hydraulic and pneumatic components of complex machinery. They take care of actuators from an industrial robotics point of view. A part from hydrology, their capability includes all required expertise in mechanics, electrical engineering and informatics, the latter for automation aspects. They have quite an efficient technology transfer, both directly a through interaction with the E7 team. Their formation of technically skilled workers should be valorised with specific institutional support and funds. The research aspects consist most in the realization of a multifunctional laboratory demonstrator, which is utilized to implement and test innovative technological solutions.

Research area of this team covers wide spectrum of problems and is under continuous development. New materials occur, new requests joined with environmental protection occur, new control systems and algorithms occur. The research area has well organized experimental sites, where it is possible to quickly operate performing adjustments, parts substitution, modifications, up-gradings and prototype improvements always in compliance with job safety rules.

The team in Bucharest, occupying a different location from Magurele, for historical reasons and due to the persistent need of large spaces to set up prototypes by assembling mechanical parts and control instruments.

Scientific achievements: This group has no publications in ISI journals. It is clear that publishing of output of an applied research, on which this team is focused dominantly, in ISI journals, is much trickier than publishing of results of a basic research. But it is absolutely necessary to improve the situation in this field. The team has 33 papers in indexed conferences, published 6 books and 3 book chapters, 2 of which are published in international publishing houses.

Transferable results: The team has 19 approved national patents, no international one. Transferable results portfolio is very rich, it consisting of 8 transferable products, 27 technologies, 2 methods and innovative services. 9 results of the research work of this group were transferred already.

The interaction with 8 University Centers, 12 Research Institutes and 54 SMEs demonstrates the successful start-up work mainly expressed on the national territory. Dedicated spaces are present where INOE researchers and personnel from industries work together in order to realize and test prototypes prior to proceed with patent applications.

Human resources: The research team consists of 21 researches and engineers for development of technologies, 9 of them are Ph.D., 1 is a Ph.D. student. The team has a good structure. Chemical physics and engineering skills are well integrated, a large part of the team's success is due to the presence of experienced mechanical technicians for the construction of the connecting parts in the mechanical structure or for the implementation of specific designs.

Education and training activities: During the period 5 Ph.D. theses and one diploma thesis were elaborated. The group organizes different types of partnership meetings and international symposium Hervex. This way it takes care for its visibility. Training activities carried out for students of undergraduate and PhD levels can be extended to secondary school students with technical direction, as well as, within the Association FLUIDAS, in order to avoid to loose the experience accumulated by senior operators.

Recommendations: It is a well established, highly experienced research team with good structure and prospective. Team has many important technological outputs and transfers. Intensity of promotion of the results is not optimal, national visibility of this team is high, it is necessary to improve international visibility. It is necessary to stress that the publications must be oriented towards ISI journals; it would be good to transform some national patent in international one. Try a little narrow portfolio of the research areas. Try to join to some international network for better visibility and internal cooperation improvement.

Technical training activities should be acknowledged with dedicated funds. An increased integration with the other INOE research teams (especially with E5), it is recommended to support them with the design and the physical realization of the INOE pilot plants.

We strongly encouraged an interaction and collaboration with the team E2 as well, which could create a synergy between an excellent experience in Materials science and in Tribology of these two teams. This could enhance the research profile of the Team E6 and give it a wider visibility in the scientific community.



## Team E7: Technology Transfer

Team leader: Eng. Simona Clara BARSAN

This team was established with the goal to provide transfer of results generated in the Institute (patents, transferable products, technologies, methods and innovative services). The team has no research; it can be characterized as a service one for the entire institute. In particular, it provides assistance in technology transfer along the whole chain, from the laboratory research - to - pilot - to - industry, with possibility of training of the industrial personnel on the transferred technology. It works also for external research groups and SMEs. It is funded on specific projects aimed at the technology transfer. Its support to INOE is relevant to patent procedure, spin-off realization, interaction with Romanian and also foreigner SMEs to any level from direct consultant contracts to searching for partnership in European projects. Team E7 operates as support to the other teams on results transferability and looks for opportunities to integrate the INOE activities with other research programs particularly in Europe. To this aim there is an active cooperation with the INOE Scientific Council, whose work integrates well the aspects of the team E7 through the organization of presentations, discussion tables and more other. They take care of specific dissemination towards SMEs and have realized a SME data base to suggest partnerships. The skills of the staff, mainly with engineering, formation have been directed towards the knowledge of European directives in training courses on business matchmaking and brokerage technique, creating a professional figure able to understand the issues and promote industry-wide initiatives in the European programs. They also follow European courses for helping in legal issues related to project acquisition and management.

The locations of the two groups in different country areas (Cluj and Bucharest) makes continuity of the management of the entire Institute more complicated but possible, by forming the cohesive element that often activities targeted to industrial purposes do not possess.

### Transferable results portfolio:

The portfolio consists of 45 patents registered at national level, 8 transferable products, 27 technologies, 2 methods and many innovative services.

### Results achieved:

During last 4 years some results were transferred to 10 companies interested in manufacturing new products, services were provided in patent proceedings of 25 patent applications, inception of 3 spin-offs of the institute and support of setting-up of a start-up entity.

### Human resources:

The team consists of 9 technology development engineers, 6 researchers and 1 inferior engineer (2 Ph.D., 1 Ph.D. student). 5 team members were educated in the field of intellectual property rights in abroad.

### Recommendations:

The complexity of today's standards in the field of European projects and the interaction with the property transfer rights, suggests the inclusion in the staff of personnel units of expertise in national and international legislation. In particular, government support should be ensured in order to place permanently some team E7 staff members at the European structures, thanks to the expertise acquired in the field of technology design at international level.

3) Justification of the mark awarded, for each of the 5 criteria, highlighting strengths and weaknesses, in accordance with the minutes/report of the visit (2 pages)

### **C1 The quality of R&D activities and their results:**

**4.0**

The potentiality offered by Institute and a correct policy of realization of infrastructure collocate actually the institute as one of the reference point in Romania and in a near future among the relevant structure in Europe. The quality of scientific results and the maturity of the technological advances place the Institute at a high level, not only at the national level but also at the international one.

Teams should be aware of this and should increase their publishing capacities in international journals with a high impact factor. An effort towards internationalization of patents should be done.

Strengths: Results are very good, with positive future trends for publications and international funds. Some of the teams are very active, maintain high profile international connections, a good training track and are able to reach sufficient funding in both national and international schemes. Four high qualified research teams (E1 – E4) are at top international level. Significant industrial research is carried on at national level for the others (E5 – E6). The research teams showed their capability to adapt, modify, improve and integrate the technological devices both in currently addressed objectives and in future technological developments. A dedicated technology transfer team is present for results dissemination (E7) and exploitation.

Weaknesses: Some observed inhomogeneities research results should be ascribed to the relatively young age (less than 20 years) of the Institute, with an incomplete integration process, especially among the three distinct territorial research units in Magurele, Bucharest and Cluj. Some lack of an original traditional line on common research themes, which might insure a continuity in the future researchers, is felt. Differences of scientific level and degree of internationalization are observed among the teams, together with an incomplete integration among them. Research products are pretty abundant but to an excessive amount are limited to Romania.

Justification of the mark: The importance of number top quality research products would deserve a top score. The lower average mark achieved accounts for the limited internationalization currently achieved both in publication and patents, partially balanced by a positive trend perspective.

### **C2 Human resources Quality:**

**4.5**

The Institute employs a good number of scientists of recognized international prestige; however the scientific performance of research personnel is not uniform and some of the teams are not that productive. The Institute is in continuous need to attract and train young researchers at Ph.D. and postdoctoral levels to ensure continuity of some lines and to start new ones. The part of administrative staff is the force of cohesion in the institute by contributing to its external visibility by promoting the participation at events not specifically of scientific relevance.

Strengths: All teams appear very active and well addressed to the applied research pursued. The staff is well motivated, fully believing in the future of the institute. Well balanced number of efficient and fully motivated administrative staff. Some teams demonstrate their capability to attract young researchers who have been trained in foreign laboratories of high scientific reputation.

Weaknesses: Possible under critical human resources relying too much on PhD students, which are engaged as part-time staff. In spite of a significant group of young people in each team, the average age is high (44 years) and the internal mobility does not appear favored.

Justification of the mark: The quality and motivation of the human resources, together with their optimized distribution (among research employees, technicians and administrative staff) would deserve top score, however some inhomogeneous distribution of young resources prevent to reach the maximum.

### **C3 Quality infrastructure and its rate of exploitation:**

**5.0**

The Institute, although the many investment uncertainties, succeeded to create a rich and advanced scientific infrastructure. The obtained scientific and technological results of the last 5 years allow supporting the development plan of each team and consequently its implementation in terms of enrichment of such infrastructure in order to match the new needs and challenges. The possibility to answer to almost the totality of external requirement of applied research owing to the wide technology apparatus available.

Strengths: The ability demonstrated by some teams to attract and manage funds for development of new infrastructure. Most infrastructures are pretty new, hosting very good equipment with adequate technical support for operation and

maintenance. Current exploitation rate is good, with possibility of further improvement in short for the most recent laboratories with new instruments on testing.

Weaknesses: Current excessive project oriented utilization. A possible future threat can arise from the difficulty in securing an important cash flow for functioning and maintenance of the newly developed infrastructure in an unstable funding environment.

Justification of the mark: Top quality infrastructures, good exploitation rate with perspective of further improvement.

#### **C4 Management efficiency and quality of the research environment: 5.0**

The Institute is managed efficiently with a good degree of involvement of the scientific personnel in strategic planning. Potentiality to implement transversal research applications covering larger number of topics within the next horizon 2020 program is present.

Strengths: Staff motivation, shared and transparent decisions, joint plans. The management is aware of strengths and opportunities and has exerted a healthy degree of self-criticism.

Weaknesses: Scattered activities are present, related to specific research projects. The lack of a fully shared background of competence in optoelectronics might affect in the future possibilities of internal mobility. The management seems to be in a weak position regarding the increase of interconnection between the territorial research units.

Justification of the mark: Current top level.

#### **C5 Quality and credibility of the institutional development plan 4.5**

The Institute presented six specific objectives in the definition of the strategy development plan and the priority directions specific to each of the 7 teams. The Institute plan reflects all the crucial issues for development in the coming years. The Institute has huge internal development potential, but should address also external opportunities. The experience of these last 4 years is a very important background to be considered for the creation of new forms of participation to national and international systems for research and development.

The competence and the international estimation acquired in this last period should suggest a more relevant participation in the state key areas; an important emerging issue is the experience in the certification and patents that could be extended on European scale. Formation activities for technical workers should be acknowledged at national and international levels.

Strengths: The so-defined priority directions fit well the major scientific performance at Europe level in terms of challenging research (like health, energy, environment, e-science, cultural heritage) with the potential to provide the Institute the basis for a competitive research, with state-of-the art equipment.

The institute has already prestigious collaborations and also partnerships with excellent perspective to be continued and reinforced within European or bilateral projects.

Weaknesses: Each team apparently defined his own strategy without a clear common vision at the Institute. The activity of some teams does not clearly fit with the stated main objectives and directions.

The Institute seems to neglect opportunities offered by the current development of local infrastructure of international importance in the field (e.g. CETAL and ELI).

There is a scarce participation of INOE, as Romanian representative, in European and world evaluation commissions on some relevant research activities, e.g. for climatic changes or renewable energies.

Justification of the mark: Reaching fully top level would require an institutional development plan more addressed towards internal integration and a shared competence background in optoelectronics. International weight may also be further improved.

4) Only for institutions classified "A-": Specific measures, targets and recommendations to be met in a time of 2 or 3 years (2 pages).







**Overall technical considerations, observations, conclusions:**

INOE is an institute performing high quality research, at international level on a few specific thematic, with a good management and excellent perspectives related to the fairly new infrastructures realized and the high quality human resources available. Integration among the team and among different local subsidiaries, together with an overall strategy plan should be cared more. Human resources, currently satisfactory, might become an issue in the future if possibilities of internal mobility are not favored with enforcing the common competence background and adopting proper recruitment procedures. Internationalization, pursued with different efforts in the teams, should be more a task for the entire institute in order to increase visibility and rate of success in Europe and all over the world.

A part from applied and industrial research, technology transfer is definitely in the INOE task, and the increasing success of all relevant activities (patents, spin-off, support to SME internationalization), with interesting international perspectives, is testifying this point.

In conclusion a strong support to the institute development is recommended to the National Romanian Authority for Scientific Research (ANCS) in order to support Romanian economy along the direction of innovation towards European standards.

**Proposed certification level: ...A<sup>+</sup>...(average mark 4.6).....**

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2	Evaluator 2 - Daniela Ferro	 Daniela Ferro
3	Evaluator 3 - Pavel Mach	
4	Evaluator 4 - Roberta Fantoni	
5	Evaluator 5 - Nadhira Bensaada Laidani	
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