

Europe and International Department

EVALUATION AND ACCREDITATION DOCUMENTS

Ph.D. Materials science and engineering

African University of Science and Technology (AUST) - Pan African Materials Institute (PAMI), Abuja

Nigeria

September 2019

Rapport publié le 21/11/2019

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International evaluation and accreditation

EVALUATION REPORT

Ph.D. Materials science and engineering

African University of Science and Technology (AUST) - Pan African Materials Institute (PAMI), Abuja

MAY - 2019



The AUST has mandated the Hcéres to perform the evaluation of its MSc. In Materials Science and Engineering programme. The evaluation is based on the "External Evaluation Standards" of foreign study programmes, adopted by the Hcéres Board on October 4th, 2016. These standards are available on the Hcéres website (hceres.fr).

For the Hcéres¹:

Michel Cosnard, President

On behalf of the experts committee²:

Carole Molina Jouve, President of the committee

In accordance with the decree n°2014-1365, November 14th, 2014,

¹ The president of Hcéres "contresigne les rapports d'évaluation établis par les comités d'experts et signés par leur président." (Article 8, alinéa 5) – « countersigns the assessment reports made by the experts' committees and signed by their president »(article8, alinéa 5)

² The evaluation reports "sont signés par le président du comité". (Article 11, alinéa 2) – « are signed by the president of the committee » (article 11, alinea 2)



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I. NATIONAL CONTEXT AND INSTITUTION IDENTITY SHEET

INSTITUTION

- 1. University/institution: African University of Science and Technology (AUST), Nigeria
- 2. Component, faculty or department concerned: Pan African Materials Institute (PAMI), administered by the Materials Science and Engineering Department
- 3. Programme's title: PhD in Materials Science and Engineering
- 4. Training/speciality: Sub-specializations in Biomaterials, Energy materials, Minerals and Multifunctional materials
- 5. Year of creation and context: 2007, creation of a MSc. and a PhD in materials sciences and engineering.
- 6. Site(s) where the programme is taught (Town and campus): Galadimawa, Abuja
- 7. Programme director: ONWUALU Peter Azikiwe, Professor, specialized in Mechanical properties of materials

METHODS AND RESULTS OF THE PREVIOUS ACCREDITATION(S)

Methodology and agency:

All of the postgraduate programmes of AUST were accredited in April 2017 by the NUC (National Universities Commission), for 5 years

A gap analysis was also made by the ABET (American Board of Engineering and Technology) in June 2017

Results

The NUC accredited the MSc Science & Engineering with the best score (87.8%) of the AUST programmes. The NUC reports some strengths: Academic contents, course evaluation, staffing, course delivery and facilities, library and two main weaknesses: funding and the low involvement of junior staff in writing research grants for the programme; the low ratio of academic staff that benefits from the staff development programme.

The ABET concluded that the M.Sc. program in Materials Science and Engineering produces graduate students who are well prepared to contribute to the development of industrial applications in the effective use of natural materials resources in Africa. ABET also provided some recommendations, that can be summarized as follows:

- Ensure that all students that graduate have sufficient credits in basic sciences and basic engineering topics,
- Establish a closer relationship with industry,
- Increase the number of resident lecturers and professors (to many invited faculties)
- Continue to develop the laboratory spaces (staff, material, safety measures)
- The communication about programme objectives, student enrollment and outcomes must be done, preferably on the programme's web site.
- A stable electrical power must be provided.

HUMAN AND MATERIAL RESOURCES DEDICATED TO THE PROGRAMME

8. Human resources

The teaching staff is composed of 19 professors and associate professors. Only 3 of them are currently resident faculty, and 16 are invited faculties, mainly from USA and Europe. 2 new residents will reinforce the PAMI teaching staff in July 2019

The non-teaching staff is composed of two lab-technologists, two ICT assistants and one administrative assistant.

9. Material resources

Students have access to two physical libraries and an e-library, modern computers and scientific software in a computer center; a Materials Science Building with an auditorium, several classrooms and 8 lab spaces.

The material characterization labs are very well equiped, with new devices as, for example, nanoindenter, SEM and X-ray defractometer.



STUDENT POPULATION: EVOLUTION AND TYPOLOGY OVER THE LAST 4 YEARS

YEAR	ENROLMENT					TOTAL NO. AT	
	FULL-TIME		PART-TIN	ΛE	NATIONALI	ITIES	
	Male	Female	Male	Female	Nigerian	Non-Nigerian	
2018/19	29	17	-	-	31	15	46
2017/18	9	5	-	-	11	3	14
2016/17	7	5	-	-	11	1	12
2015/16	NIL	NIL	-	-	NIL	NIL	NIL

The target of the PAMI is to enroll 100 PhD students per year.

II. EVALUATION PROCEDURE

COMPOSITION OF THE EXPERTS PANEL

President:

Pierre HALDENWANG, pierre.haldenwang@univ-amu.fr, Professor Emeritus at Aix-Marseille Université (Specialty: Physics, Mechanics). Expert for the department in charge of the evaluation of institutions (DEE), and for the department in charge of the evaluation of research (DER) of Hcéres.

Expert members:

- Catherine XUEREB, <u>catherine.xuereb@inp-toulouse.fr</u>, CNRS Research Director, (Specialty: Chemical Engineering), Vice President of Toulouse Polytechnic National Institut. Expert for the department of the evaluation of institutions (DEE) and for the department in charge of the evaluation of clusters of Higher Education and Research institutions (DECT) of Hcéres.
- Thibaud LECOMPTE, thibaut.lecompte@univ-ubs.fr, Assistant Professor at Université Bretagne Sud, habilité à diriger des recherches (Specialty: Mechanics des matériaux, eco materials, génie civil). Expert for the department in charge of the evaluation of programmes (DEF).
- Anass NAGIH, <u>anass.nagih@univ-lorraine.fr</u>, Professor at Université de Lorraine (Specialty: Computer Science). Expert for the department in charge of the evaluation of programmes (DEF) and for the Europe and international department (DEI) of Hcéres.
- Valentin LE BOEUF, valentin.le-boeuf@ens-paris-saclay.fr, Student Expert. Ecole Normale Supérieure Paris Saclay Graduate. (Specialty: Electrical Engineering). Expert for the department in charge of the evaluation of programmes (DEF) and for the Europe and international department (DEI) of Hcéres.

The Hcéres institution was represented by: Pr. Pierre COURTELLEMONT, Science Advisor



ON-SITE VISIT DESCRIPTION

- Date of the visit: May the 21st, 2019.
- Organization of the visit: the visit was made the 21st of May, on the site of the African University of Science and technology (AUST) in Abuja, during one day. Meetings with the management team, academic staff, closed meetings with partners, alumni and students.
- Cooperation of study programme and institution to be accredited: perfect cooperation by all stakeholders, with the support of NUC team.
- People met:

Peter Onwualu, Professor, Co Centre Leader Abdulhakeem Bello, Assistant Professor Kenfack Anatole, Associate Professor (Berlin) Rajesh Prasad, Associate Professor (New Delhi) S. Ma'aruf Minjibir, Post-doc Obi Ben Okonkwo, Finance Officer Onyebuchi Ekpolomo, Head Library Services Oroha Inewbendre, Academic Registrar Augustine I Keagwu, Internal Auditor Atulomah Obioha, Communication Officer

Students of Material Science Engineering:

In MSc:

Abu Usman Onuminya, Ayuk Corlbert Ayuk, Ndeh Yvette Neh (Cameroon), Uba Chukwudalu, Obi Uchenna (Niger), Eya Henry Igwebuike, Mohammed B. Dukury (Liberia), Waidi Yusuf Olatunji, Udofia Benjamin Etim, Aliyu Joseph Oluwafemi

Bukar Y Abdullahi, Kalu-Uka Godwin M, Olarewaju Yusuf Afolabi, Ezealigo Uchechukwu Stella, Ngasoh Fayen Odette (Cameroon), Kingsley Ikechukwu Orisekeh, Itohan Ojeaga, Ezenwafor Theresa, Ekwe Nneka Blessing, Anosike Esther Nneka, Toyin Aina, Numfor Linda Bih (Cameroon), Daniel Iremofu Amune, Akpan Udom Mark, Emmanuel Ogo Onche, Gina Chukwu Odochi

III. PRESENTATION OF THE STUDY PROGRAMME

1 – PRESENTATION OF THE STUDY PROGRAMME

The PhD in "Materials Science and Engineering" study programme consists in enrolling the PhD students in a thesis project of 3 to 7 years.

2 - PRESENTATION OF THE PROGRAMME'S SELF-EVALUATION APPROACH

A quite complete self-evaluation was made by the institution in two files called "Self-evaluation form" and "self-evaluation report"; Both documents describe the identity of the PAMI, the academic and non-academic staff, the facilities, the lab equipment, the enrolments for years 2013 to 2018. It gives a brief history of the programme, with three highlights:

- first enrolments in 2008 in PhD as well as in MSc,
- a lot of partnering institutions from abroad,
- the diversity of the enrolled students, and the multidisciplinary programme.

The aim of the programme is well defined as "to train the next generation of Materials Scientists and Engineers that will solve the resource curse problem of Africa. The program, evaluation policy and university laws applied to the MSc are described in-detail and very clearly.



A SWOT analysis is carried out. The main identified strengths in the self-evaluation are the outstanding teaching and research, the teaching environment, the high quality of enrolled students and the strong connections to industry. The weaknesses raised by the self-evaluation concern the funding, the power supply instabilities and the limited size of the research groups.

IV. EVALUATION REPORT

ARFA 1 – THE POSITIONING OF THE DOCTORATE

The PAMI PhD programme presents consistent specialization topics regarding the various challenges of Africa. The different supervisors/advisors are of high scientific level. The PhD programme needs however to intensify its relationships with the industrial sector, as well as to reinforce the fundings.

The objectives of the doctoral degree are clear and well understood by the stakeholders and can be summarized as to develop and use knowledge in Materials Science to solve engineering and infrastructure problems of Africa.

The Ph.D. programme is quite well positioned and introduced in relevant faculty that gathers a rich staff of invited academics with a good scientific production in well-impacted journals, ensuring a good level of effectiveness in the doctoral programme. There are clearly a lot of collaborations and exchanges with research centers abroad.

The three current specializations: Multifunctional Materials, Biomaterials and Energy, are very specific and distinct topics. They are evidently consistent with the Africa challenges in terms of materials science and engineering. However, even though some industrials, like Total, are involved in some specific projects, the funding and relationships with the industrial sector remains tiny and this aspect should be reinforced (for example thanks to the creation of university chairs or the development of recurrent industrial scholarships)

AREA 2 – ORGANIZATION AND MANAGEMENT OF THE DOCTORATE

Too many students of the PAMI PhD programme presents are supervised by the same advisors. The PhD programme possesses a good scholarship policy, a proper recruitment policy, with a good ratio of foreign students, as well as of women. The overall management requires that the resident staff is reinforced.

The Ph.D. programme is currently developed over three specific specializations: Multifunctional Materials, Biomaterials and Energy, A fourth specialization, "Minerals", will open.

The doctorate is strongly managed by the invited professors, whereas only 3 staff members over 19 are resident faculty. During the interviews, the staff asserted that 2 new recruitments will be done every year in the next decade. 2 new assistant professors are effectively recruited for 2019-2020: one specialized in Multifunctional materials (solar energy with perovskites) and one in biomaterials.

The number of PhD students supervised or co-supervised by the same professors is very high. This overloading could degrade the supervision effectiveness. This problem should be included in the considerations about the recruitments of new resident staff.

The teaching staff is provided in detail, but less has been provided concerning the administrative team and the role and responsibilities of each team member. Student representation also needs to be formalized.

Facilities are provided to students which include on-campus rooms, laundry and restaurant, library, e-library, computer center and research laboratories fitted with very proper and modern equipment.

An effective organization and management are in place for the doctorate, while the admission criteria for the targeted audience and graduation are very well defined and transparent. The students who apply for the doctoral degree program are required to have a minimum Grade Point Average of 3.5 or its equivalent. They come from the PAMI MSc as from other MScs in Africa. Student numbers and the different enrolment regimes for the study programme are clearly identified; flows of international students and female students are



identified and analyzed. The ratio of foreign students is more than 1/4 over the past 4 years.

About 50% of PhD students are in full scholarship and the other 50% in partial scholarship. Further information on the existing procedures and appropriateness of condition and financial resources for carrying out the PhD could be enlightening.

As in the MSc programme, a first 12 months of courses are structured in a way that allows students with different initial backgrounds to go up to the same level of knowledge and scientific operation. PhD students take their Qualifying Examinations at the end of this period, and can start their PhD thesis project.

AREA 3 – SUPERVISION AND TRAINING FOR DOCTORAL STUDENTS

The supervision rules have to be clearly set out and applied. The training is characterized by a good disciplinary teaching. The requirements for the students to be allowed to defend are demanding, and clearly set out.

While admission and graduation requirements are clearly set out, clearer contents are required to provide and clarify the precise and explicit rules of supervising and follow-up procedure, measuring progress and preparation for employment. Currently, only an "acceptable annual report detailing their progress" is required, but no criterions are provided to effectively assess these student progresses (advisory committee, PhD Schedule, minimum publications and communications in congress, seminar participations...)

It is clear that the PhD programme well provides the disciplinary teaching. Further details are needed on how doctorate develops awareness of research ethics and scientific integrity.

Duration of thesis is clearly set out in the provided materials. It officially lasts between 18 months and 39 months. To graduate in doctorate, the PhD-student has to publish at least 2 scientific articles in a peer-reviewed International journal and must complete a minimum of 6 courses in his specialty.

AREA 4 – INTEGRATION OF DOCTORS INTO THE JOB MARKET

The doctors are easily integrated into the (academic) job market, this professional integration is almost exclusively academic. To offer the doctors other opportunities, the communication with industries should be reinforced.

Seemingly, the students are not in effective position to develop the various opportunities of communication with the different industrial sectors, as well as with the former graduates. Some annual alumni meetings, industrial forum for internships or entrepreneurship trade fairs could be set to facilitate doctors' integration into the industrial job market. The final integration of the doctors into the job market is almost exclusively academic.

Further details are needed to demonstrate how the doctorate promotes itself domestically, the mechanisms employed at the doctorate to evaluate the graduates and to match with the job market needs. No detail was provided on the presence of any job market integration of graduates and availability of any alumni network. No information has been provided on how doctorate promote itself domestically and to the international level.

V. CONCLUSION

STRENGTHS:

- Attractiveness of PhD programme for the master students and recruitment policy
- Regional and domestic visibility
- Scholarship policy
- Supervisors skills
- Research labs equipment and facilities



WEAKNESSES:

- Low number of resident faculties (+2 in July 2019) and the overloading of PhD supervisors
- Lack in technical staff for managing laboratories (in amount and grade)
- Low transparency on certain administrative aspects and especially on what concerns the PhD students
- No established strategy for measuring progress and preparation for employment.

RECOMMENDATIONS:

PAMI must improve some management aspects, and firstly the relation of the programme with industrial sector and alumni.

For a better (and easier) management of the Doctorate, the teaching resident staff must be strongly reinforced

Recruitment of a high-grade technical staff should also be done, to enhance the use of the so-accurate and performant lab equipment.

CONCLUSION OF THE APRAISAL COMMITTEE

First of all, the appraisal Committee wants to thank the President of AUST University for the cordial welcome in his renowned institution, for the clear description of the University's policy in what concerns the PAMI PhD Programme. The Committee's members greatly appreciated the frank exchanges with their colleagues from the PAMI programme. The Committee's visit on the AUST site hence allows the overall appraisal process to get precious and honest information.

In a general manner, the Committee found the PAMI PhD programme well-adapted to the African challenges in terms of Material Science. The programme presents several important strengths, as its high-level student enrolment, which is accompanied by a peculiar recruitment policy that supports the female enrolment, as well as the appeal to foreign students. The programme is also supported by an adequate connexion with a research of international level. The latter point is fostered by the University's policy to welcome a strong invited staff of international faculties, thus leading to solid academic partnerships, The last point is evidently supported the outstanding equipment and facilities of the research laboratories associated to PAMI.

As is often the case, a strength can be associated to its corresponding weakness. Even though the presence of a huge international staff is an impressive support for the PAMI's PhD programme, the overall curriculum organisation presently lies on the shoulders of three resident colleagues. This is clearly insufficient. Even with the two additional resident professors, the overall study organisation will remain difficult for the resident staff. The PAMI PhD programme possesses interesting specializations of high-level quality, even though the outstanding equipment appeared supported by a staff too low (in number and skill) for the sophistication of certain facilities.

To help their PAMI colleagues, the Committee's members propose several points of recommendation. First of all, the PAMI programme must enrich the ratio of resident staff to international faculty members: a ratio of one half should be a short-time purpose, with "one for one" as final objective. They also encourage the University's efforts to help PAMI in terms of technical support for the research equipment. To avoid the nearly exclusive integration of the doctors into the academic job market, the PAMI PhD program should open to various industrial concerns or external economic stakeholders.

As a final consideration, the Committee would say its optimism for the short-term improvement of the PAMI PhD programme and encourages the Nigerian colleagues in the way of the recommended features.

VI. COMMENTS OF THE INSTITUTION



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26th August, 2019

HCERES Evaluation Team

Dear Colleagues,

COMMENTS ON THE EVALUATION REPORT FOR THE PhD PROGRAMME AT PAMIAUST

We have gone through the report of your team's assessment of the PhD programme at Pan African Materials Institute (PAMI) of African University of Science and Technology. We thank the team for a thorough and professional job. Our comments are as follow:

The report is a fair assessment of the PhD Programme at Pan African Materials Institute (PAMI), Materials Science and Engineering Department, African University of Science and Technology, Abuja.

However, we think that with respect to Strengths, the high level of scientific achievements by the programme as evidenced by high level publications in high impact-factor journals and in the university repository were not highlighted. Also invention disclosures made in preparation for two world-class patents in health related research were excluded.

With respect to the weaknesses, we agree with the comments. As a matter of fact, the two new resident faculty proposed to start in July 2019 have resumed work and are living on campus and the university authority is committed to its promise of sustaining this plan. The original model used by AUST, where visiting faculty formed the bulk of mentors and lecturers at AUST worked successfully in the last 10 years, paving way to the current transition to having resident faculty forming the bulk of teachers and motivators of our students and drawing from a rich pool of graduates from the system.

The Alumni group was inaugurated during the last convocation ceremony in July. They will subsequently be involved in making inputs into the curriculum. Innovative strategies have been put in place to ensure that the curriculum as conceived, is as taught, as received and is as assessed. Such strategies include the use of MOOCs, asynchronous learning and a flexible assessment method.

The Materials Industry Advisory Board is being constituted and the first meeting is scheduled in December, 2019. The peculiarities of the Nigerian economy had slowed down this process and

AUST has found a pool of industries and businesses who need higher education products for their expansion and growth, and have long term interests in the Nigerian economy.

The university inaugurated AUSTInspre in June 2019. This is the university technology business incubator aimed at promoting entrepreneurship culture among the students. The first cohort of three incubatees were selected after an entrepreneurship boot camp executed by faculty and successful entrepreneurs from Innovation Hubs in the country.

All students are currently on one month Internship in Industry. This will be increased to 3 months in subsequent years, based on the successes of the current internship efforts.

Every PhD student actually has a PhD Guidance Committee, drawn from our Visiting and Resident Faculty and those from elsewhere.

Thanks.

AR S.

Prof. Azikiwe Peter Onwualu

PAMI Co-Centre Leader

Dr. Shola OdusanyaPAMI Co-Centre Leader



International evaluation and accreditation



Ph.D. Materials science and engineering

African University of Science and Technology (AUST) - Pan African Materials Institute (PAMI), Abuja, Nigeria

September 2019



SCOPE OF THE ACCREDITATION GRANTED BY HCÉRES

Hcéres has built its evaluation process based on a set of objectives that Higher Education Institution must pursue ton ensure recognised quality within France and Europe. These objectives are divided up into six fields among which are the accreditation criteria.

As for the «External Evaluation Standards», the accreditation criteria have been specifically designed for foreign HEI. The accreditation criteria were adopted by the Board on June 2016 and are available on the Hcéres website (hceres.fr).

The accreditation committe, meeting his accreditation decision, has wholly taken into account the final evaluation report of the HEI. This accreditation decision is the result of a collegial and reasoned process.

The accreditation decision issued by Hcéres shall not grant any rights watsoever, wether in France or abroad. The decision to accredit an institution confers an accreditation label and does not infer recognition in France of the qualifications issued by the accredited institution. The Hcéres accreditation process therefore has no impact on the qualifications recognition process in France.



ANALYSIS OF THE ACCREDITATION CRITERIA

AREA 1: THE POSITIONING OF THE DOCTORATE

Accreditation criterion

The positioning, the content and the objectives of the doctorate are clearly defined. Its interactions with the stakeholders (lead institution(s), foreign partners, socio-economic environment) are formally set out and effective. Its links with the research units and the institution's scientific policy are effective.

Criterion assessment

The PAMI PhD programme presents consistent specialization topics regarding the various challenges of Africa. The different supervisors/advisors are of high scientific level. The PhD programme needs however to intensify its relationships with the industrial sector, as well as to reinforce the funding.

AREA 2: ORGANIZATION AND MANAGEMENT OF THE DOCTORATE

Accreditation criterion

The doctorate's organisation and management are clearly defined and rely on material and human resources adapted to the requirements of programmes at ISCED level 8. Internal quality assurance mechanisms are in place and effectively used in order to improve continuously the doctorate. The doctoral students recruiting is formally set out, their funding is fair and sustainable.

Criterion assessment

Too many students of the PAMI PhD programme presents are supervised by the same advisors. The PhD programme possesses a good scholarship policy, a proper recruitment policy, with a good ratio of foreign students, as well as of women. The overall management requires that the resident staff is reinforced.

AREA 3: SUPERVISION AND TRAINING FOR DOCTORAL STUDENTS

Accreditation criterion

A strict policy of supervising and follow-up of doctoral students is set. Doctoral students have access to various teaching and professional trainings and take part in scientific/professional actions. Explicit rules are defined concerning the thesis duration and defence. Measures to combat fraud, plagiarism and corruption are applied within the doctorate.

Criterion assessment

The supervision rules have to be clearly set out and applied. The training is characterized by a good disciplinary teaching. The requirements for the students to be allowed to defend are demanding, and clearly set out.

AREA 4: INTEGRATION OF DOCTORS INTO THE JOB MARKET

Accreditation criterion

The doctorate implements systems to promote the doctorate and the integration of doctors into the job market. The integration monitoring and analysis are effective and used to perform the continuous improvement of the doctorate.

Criterion assessment

The doctors are easily integrated into the (academic) job market, this professional integration is almost exclusively academic. To offer the doctors other opportunities, the communication with industries should be reinforced.



ACCREDITATION DECISION

Considering the accreditation criteria analysis detailed above, the accreditation commission takes the following decision:

"Five-year unreserved accreditation decision"

and draws attention to the various recommendations made by the committee of experts in its evaluation report:

- 1. PAMI must improve some management aspects, and firstly the relation of the programme with industrial sector and alumni.
- 2. For a better (and easier) management of the Doctorate, the teaching resident staff must be strongly reinforced.
- 3. Recruitment of a high-grade technical staff should also be done, to enhance the use of the so-accurate and performant lab equipment.

SIGNATURE

For HCERES and on behalf of

Michel COSNARD,

Midd Com

President

Date: Paris, September 4th, 2019

The evaluation reports of Hceres are available online: www.hceres.com

Evaluation of clusters of higher education and research institutions Evaluation of higher education and research institutions **Evaluation of research Evaluation of doctoral schools Evaluation of programmes** International evaluation and accreditation





