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# DMP du projet "Energy micro-GENERation with Plezoelectric biobased polymers"

*Plan de gestion de données créé à l'aide de DMP OPIDoR, basé sur le modèle "ANR - DMP template (english)" fourni par Agence nationale de la recherche (ANR).*

## Renseignements sur le plan

<b>Plan title</b>	DMP du projet "Energy micro-GENERation with Plezoelectric biobased polymers"
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## Renseignements sur le projet

<b>Project title</b>	Energy micro-GENERation with Plezoelectric biobased polymers
<b>Acronym</b>	GENEPI

## Abstract

Piezoelectric materials represent strategic elements for sensors and energy harvesters with multiple applications, in particular with the emergence of self-powered IoT devices. However, new concepts are required to tackle economic and environmental issues regarding actual lead-based piezoelectric ceramics without compromising final performances. The GENEPI project consequently investigates the spontaneous shear piezoelectricity of poly(L-Lactide) (PLA) as an ideal alternative with many positive benefits. An industrially-relevant and solvent-free extrusion-orientation (MDO) fabrication process is currently under development at IMT Lille Douai to open a straightforward fabrication of PLA-based sensors / harvesters but several scientific challenges need to be overcome to get a full expertise on these technologies and enable faster developments. In this context, the first scientific objective of GENEPI project is to improve the knowledge on shear piezoelectric properties of PLA, in particular on process – structures – properties relationships and the use of (meth)acrylic block copolymers as blending partners to develop high-performance shear piezoelectric films at the laboratory scale. The second scientific objective of the GENEPI project is to convert the peculiar piezoelectricity of PLA into a conventional ferroelectric behavior in order to boost piezoelectric properties of PLA beyond the theoretical limit with electromechanical responses in practical mechanical modes for sensing / actuation / harvesting operations. This challenging task will explore several concepts (high-temperature ferroelectricity of PLA, pseudo-ferroelectricity of nanostructured PLA-based blends and electric field-assisted crystallization of PLA) to reveal long-term research strategies.

## Funding

- French National Research Agency : ANR-21-CE06-0003

**Start date** 2022-01-01

**End date** 2025-12-31

## Produits de recherche :

1. Processing parameters, physico-chemical properties and piezoelectric properties of PLA (Dataset)

## Contributeurs

Name	Affiliation	Rôles
SAMUEL Cédric - 0000-0003-0101-4992	Centre d'Enseignement de Recherche et d'Innovation Matériaux et Procédés	<ul style="list-style-type: none"><li>• DMP manager</li><li>• Personne contact pour les données</li><li>• Project coordinator</li></ul>

Droits d'auteur :

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## 1. Data description and collection or re-use of existing data

### 1a. How will new data be collected or produced and/or how will existing data be re-used?

Data will be collected by all project members (project coordinator, students and engineers / technicians).

Materials processing conditions will be recorded in laboratory notebooks (and transcribed into electronic versions for further data treatments).

Material analysis (DSC, TGA, DMA, FTIR, XRD, piezoelectricity, etc...) will be directly collected with specific softwares (and transcribed into useful electronic versions for further data treatments).

No anterior data is expected to be used.

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### 1b. What data (for example the kind, formats, and volumes), will be collected or produced?

During the GENEPI project, several types of data will be produced :

1 - Physico-chemical properties of raw materials (industrial or custom PLA grades) - Raw numeric datas from specific softwares, textual data from laboratory notebooks converted into useful numeric formats (.txt, .docx, .xlsx, .pptx, .pdf) - Unknown volumes

2 - Data regarding the processing / manufacturing of piezoelectric PLA - Textual data from laboratory notebooks converted into useful numeric formats (.txt, .docx, .xlsx, .pptx, .pdf) - Unknown volumes

3 - Physico-chemical properties of piezoelectric PLA - Raw numeric datas from specific softwares and textual data from laboratory notebooks converted into useful numeric formats (.txt, .docx, .xlsx, .pptx, .pdf) - Unknown volumes

4 - Data regarding the processing / manufacturing of prototypes - Textual data from laboratory notebooks converted into useful numeric formats (.txt, .docx, .xlsx, .pptx, .pdf) - Unknown volumes

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## 2. Documentation and data quality

### 2a. What metadata and documentation (for example the methodology of data collection and way of organising data) will accompany the data?

During the GENEPI project, data will be classified into sub-projects. Sub-projects usually correspond to a specific study done by a student during a limited time period.

Into each sub-project, all datas will be organized according to the type of characterization (for instance XRD, DSC, FTIR, Piezo, etc...). Reports and presentations will be also added to this sub-project. A convention for file names will set to : date (AAAMMJJ), type of experiments (X), type of materials (X), Experiment number (X).

Note that the projet coordinator wil also gather all important results (processing conditions, physico-chemical data and piezoelectric data) into a general file.

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### 2b. What data quality control measures will be used?

Processing equipments and characterization devices of the IMT Nord Europe are subject to the ISO 9001 quality control. The calibration methods and maintenance are directly managed by the platform managers.

Good laboratory practices will be followed by all project members. The project coordinator / supervisor will ensure the quality of the collected data. Reproducibility tests will be also carried out whenever necessary to verify the data.

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### 3. Storage and backup during the research process

#### 3a. How will data and metadata be stored and backed up during the research?

During the GENEPI project, data et metadata will be stored on members' encrypted workstations and specific workstations for material characterizations. Each member will insure regular backups of their data and metadata (ideally every month) on IMT servers. At the end of the project, the project coordinator will insure that all data are correctly stored on IMT secure servers.

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#### 3b. How will data security and protection of sensitive data be taken care during the research

In case of incident, the data and metadata can be easily recovered from backups on IMT secure servers (or in the worst case, from personal backups on an external hard drives). All the scientists involved in the project will have access to data and metadata by asking to project coordinator. Data and metadata will be shared via IMT secure servers (secured by the France Ministry). In terms of data protection, all participant will comply with internal policy.

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### 4. Legal and ethical requirements, code of conduct

#### 4a. If personal data are processed, how will compliance with legislation on personal data and on security be ensured?

No collection of personal data is envisioned over the duration of the GENEPI project and consequently the risk relating to personal data dissemination is minimized.

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#### 4b. How will other legal issues, such as intellectual property rights and ownership, be managed? What legislation is applicable?

Each participant involved in the GENEPI project will respect IMT rules in terms of intellectual property rights and ownership. Each participant will be associated to publications according to their respective contributions.

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#### 4c. What ethical issues and codes of conduct are there, and how will they be taken into account?

As a general rule, each participant involved in the GENEPI project will agree to respect the rules of research ethics.

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### 5. Data sharing and long-term preservation

#### 5a. How and when will data be shared? Are there possible restrictions to data sharing or embargo reasons?

Before publication, data will be eventually shared between participants using the IMT secure server after a specific request to the

project coordinator. Data sharing will depend on data sensitivity. Concerning published data, in order to promote data accessibility, open access publications will be favored whenever possible and all data will be posted in public repositories like HAL or other data sharing systems. Long-term data sharing will be done in compliance with journal or patent agency embargo rules where applicable.

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**5b. How will data for preservation be selected, and where data will be preserved long-term (for example a data repository or archive)?**

As a global rule, all data concerning the GENEPI project will be stored permanently on IMT secure servers. Open data and dataset will be made available for an extended long time period using various platforms like HAL and Zenodo.

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**5c. What methods or software tools are needed to access and use data?**

As much as possible, standard softwares will be favored for published and open data (format like .txt, .docx, .xlsx, .pptx, .pdf, etc...)

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**5d. How will the application of a unique and persistent identifier (such as a Digital Object Identifier (DOI)) to each data set be ensured?**

The application of a DOI to scientific publication and datasets will be insured by journal editors and by Zenodo.

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## **6. Data management responsibilities and resources**

**6a. Who (for example role, position, and institution) will be responsible for data management (i.e. the data steward)?**

The scientific manager of the project will be in charge of data management. Data entry, production of metadata, data quality monitoring as well as data storage and sharing will be insured by all participants of the GENEPI project.

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**6b. What resources (for example financial and time) will be dedicated to data management and ensuring that data will be FAIR (Findable, Accessible, Interoperable, Re-usable)?**

The project manager and PhD students will insure that data generated by the GENEPI project are FAIR as much as possible. Some financial resources will be allocated by IMT for data management and backup at the end of the project.