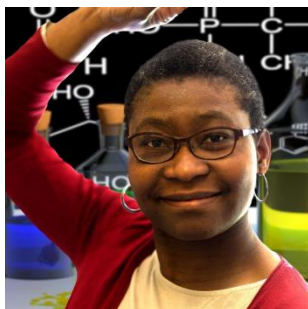


Dr. Yvette NGONO-RAVACHE

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Yvette Ngono-Ravache has a multidisciplinary background. Educated in chemistry, she holds a PhD in physical-chemistry and has been studying polymers under ionizing radiations (physics of irradiation, mechanisms of defects creation, radio-oxidation and gas emission) for 23 years. She has a solid expertise in the study of polymers under ionizing radiations (α , β , γ and ion beams). She has been working for the last decades in polymer tailoring so to adapt the material to the specific process under study and this is a paradigm shift in the study of organic materials under irradiation.

Activity and specialty: Polymer ageing Under Ionizing Radiations

Physical-chemical modifications of polymers submitted to ionizing radiations: mechanisms of defects creation, radiation/matter interactions, polymer synthesis and chemical tailoring, energy transfers under ionizing radiations

- Characterization and quantification of radiation-induced defects (macromolecular defects and gas emission) : influence of irradiation parameters
- Study of the mechanisms of macromolecular defects creation and gas emission
- Influence of the irradiation temperature : kinetics of defect creation and temporal structure of defects formation
- Radiation-induced oxidation : parameters of influence and quantification
- Energy transfers in polymers submitted to ionizing radiations : influence of the chemical composition of the material in its behavior under irradiation
- Influence of the radiation characteristics : the specificity of Swift Heavy Ions
- Influence of the hydration kinetics and the hydration level of the polymer in its stability under irradiation.
- Study of the Interaction configurations of H₂O molecules and their evolution with irradiation level in epoxy resins. Hydrogen bond network in polymers
- Specificity of Swift Heavy ion irradiation in organic materials

Development of experimental set-up for on-line analyses associated with kinetics studies. Thin film (few 100 nm level) deposition and characterization, chemical hydrogenation and oxidation of C=C bonds containing polymers.

Specialist in spectroscopy: Mass spectroscopy, Infrared, NMR (¹H, ¹³C), UV-visible

Education

2016 : **HDR** (Normandy University). Physical-chemical modifications of polymers submitted to ionizing radiations

1999: **PhD** (Université Joseph Fourier Grenoble) “Long-term behavior of epoxy resins submitted to ionizing radiation: influence of water”

1996: **DEA** in chemistry option “processes in liquid and interfaces”

1996: **Engineer in Chemistry** option chemical engineering (ENSCCF now Sigma Clermont-Ferrand)

Work Experience

2018 : CEA Senior Expert in polymer ageing under ionizing radiations

2017 : E5 level at CEA (equivalent to a Professor at the University)

2001 ⇨: **Research scientist** in CEA (French Alternative and Atomic Energies Commission). Located at the CIMAP laboratory at Caen

Basic Science

- Physical-chemical ageing of polymers submitted to ionizing radiations:
 - Study of ageing mechanisms: defects creation kinetics + temporal structure
 - Influence of irradiation and environment parameters
 - Influence of the LET and the ionizing and excitation density on polymer behavior under particle (accelerated electrons and swift heavy ions) irradiation
 - Radiation-induced oxidation : kinetic constants determination and influence of irradiation parameters
 - How can the homogeneous model from photo-oxidation applied to ionizing radiation–induced oxidation?
 - Mechanisms of track formation in dosimeters
- Energy transfers under irradiation
 - Adapting the polymer to the study : polymers synthesis and tailoring
 - Influence of radiation-induced defects in the behavior of the polymer under high irradiation doses
 - Specification of energy transfers: species or excitations transfers?
- Polymers of biological interest under irradiation
 - An introduction of type II collagen behavior under ion beam irradiations

Applied research [AREVA (Now ORANO), EDF, REEL]

- Stability of epoxy resins in complex irradiation conditions with multiple constraints including liquid water or humidity
- Polymers under alpha radiolysis. Effect of high doses and long-time irradiations.
 - Gas emission: quantification of H₂ emission yield and assessment of its evolution as a function of the irradiation dose and the beam characteristics. Application to Intermediate-Level-Long Lived (ILLW) Waste packaged contaminated with α emitters.

- Chemical structure and mechanical properties: Nuclear Plant cables in conditions of a severe accident (EDF)

2000-2001: Post-doctoral position (INRA, Reims). Novel routes for polymer recycling: assessing pollutant migration and diffusion during processing.

1996-1999: PhD preparation at CEA Grenoble. Chemistry option Physics

- Epoxy resins under the combined action of ionizing radiations, oxygen and humidity
- Influence of the irradiation level on the hydration of epoxy resins and the interaction configurations of H₂O molecules in these resins.
- Influence of the curing agent chemical composition on the oxidation of cured epoxy resins.

Research related activities

- ✓ *Conferences* : 12 oral presentations + 8 invited talks
- ✓ *Chairperson of the IRaP 2016* (Ionizing Radiation & Polymers) international conference.
- ✓ Invited Editor for the *Radiation Physics and Chemistry Journal* for the special edition
- ✓ *Supervision activities*: 5 PhD, 3 Post-docs and 9 undergraduate students
- ✓ *Communication*: contact person for CIMAP since 2005

Teaching activities

- ✓ Since 2011 (IUT Caen): course on Nuclear Plants and the fuel cycle (16hr/year)
- ✓ Since 2019 (Le Havre University, M2) : course Nuclear power (6hr/year)

Publications

Reference Modules or book sections

Ferry M. , Roma G., Cochin F. , Esnouf S. , Dauvois V., Nizeyimana F. , Gervais B. , Ngono-Ravache Y.
Polymers in the nuclear power industry,
 Comprehensive Nuclear Materials, 2nd Edition, Elsevier , **2020** chapter 9 PP 1-66
 10.1016/B978-0-12-803581-8.11616-9,
<https://www.sciencedirect.com/science/article/pii/B9780128035818116169>

Ferry M., Ngono-Ravache Y., Aymes-Chodur C., Clochard M.C., Coqueret X., Cortella L., Pellizzi E., Rouif S., Esnouf S., *Ionizing Radiation Effects in Polymers*
 Reference Module in Materials Science and Materials Engineering, **2016**,
<http://www.sciencedirect.com/science/article/pii/B9780128035818020956>

Regular articles

Alkaline hydrolysis of radio-oxidized aliphatic polymers, Ferry M., Dannoux-papin A., Legand S., Exposito E., Durand D., Ngono-Ravache Y., Esnouf S., *radiation Physics and Chemistry*, Jul. **2020**
<https://doi.org/10.1016/j.radphyschem.2020.108783>

Ferry M., Ramillon J.M., Been T., Lutz P.J., Ngono-Ravache Y., Balanzat E., *Energy migration effect on the formation mechanism of different unsaturations in ethylene/styrene random copolymers*,
 Polymer Degradation and Stability, **2019**, Vol.160, Pages: 210-7,
 10.1016/j.polymdegradstab.2018.12.026

Kusumoto T., Ngonon-Ravache Y., Balanzat E., Galindo C., Ludwig N., Raffy Q., Yamauchi T., Kodaira S., Barillon R., *The role of molecular and radical mobility in the creation of CO₂ molecules and OH groups in PADC irradiated with C and O ions*, Polymer Degradation & Stability, **2019**, Vol. 164, Pages: 102-8, 10.1016/j.polymdegradstab.2019.04.007

Boughattas, I.; Labeled, V.; Gerenton, A.; et al. *Hydration effect on ion exchange resin irradiated by swift heavy ions and gamma rays*, Journal of Nuclear Materials, Volume 504 JUN **2018**, Pages: 68-78

Chupin F., Dannoux-Papin A., Ngonon-Ravache Y., D'Espinose de lacaillerie J-B. *Water content and porosity effect on hydrogen radiolytic yields of geopolymers*, J. Nuclear Materials, Vol. 494, Oct **2017**, PP 138-146, doi.org/10.1016/j.jnucmat.2017.07.005

Bouhier M.; Vignero G; Ngonon-Ravache. Y; Shirdhonkar. M; Renault JP.; Le Caer S., *In situ and time-resolved infrared detection of the reactivity induced by electrons in polymer films*. Review of Scientific instruments, Volume 88, Issue 3, Art n° 034102 DOI: 10.1063/1.4978442, Mar **2017**

Ventura A., Ngonon-Ravache Y., Marie H., Levavasseur-Marie D., Legay R., Dauvois V., Chenal T., Visseaux M., Balanzat E., *Hydrogen Emission and Macromolecular Radiation-Induced Defects in Polyethylene Irradiated Under Inert Atmosphere: The Role of Energy Transfers Towards Trans-Vinylene Unsaturations*. J. Phys. Chem. B. Oct **2016**, Volume: 120 Issue: 39 Pages: 10367-10380 DOI 10.1021/acs.jpcc.6b04503

Ngonon-Ravache, Yvette; Ferry, Muriel; Esnouf, Stephane; et al. *Polymers under Ionizing Radiations: the Specificity of Swift Heavy Ions* . Book Series: EPJ Web of Conferences Volume: 115 Article Number: UNSP 02003 Published: **2016**

Durantel, Florent; Balanzat, Emmanuel; Cassimi, Amine; et al., *Dosimetry for radiobiology experiments at GANIL NIM A* Volume 816, April **2016**, Pages: 70-77

Martin, S., Ji, M., Bernard, J., Bredy, R., Concina, B., Allouche, AR., Joblin, C., Ortega, C., Montagne, G., Cassimi, A., Ngonon-Ravache, Y., Chen, L. *Fast radiative cooling of anthracene: Dependence on internal energy*, Physical Review A, **2015**, Volume 92, Issue5, Article Number 053425

Ngonon-Ravache Y., Damaj Z., Dannoux-Papin A., Ferry M., Esnouf S., Cochin F., De Combarieu G., Balanzat E., *Effect of swift heavy ions on an EPDM elastomer in the presence of oxygen: LET effect on the radiation-induced chemical ageing*. Polymer Degradation and Stability, **2015**, Volume 111, January 2015, Pages 89-101

Ventura A., Chenal T., Bria M., Bonnet F., Zinck, Ph., Ngonon-Ravache Y. Balanzat E. Visseaux M., *Trans-stereospecific polymerization of butadiene and random copolymerization with styrene using borohydrido neodymium magnesium dialkyl catalysts*. 2013 European Polymer Journal, **2013**, Vol. 49, pages 4130-4140

Ferry M., Bessy E., Harris H., Lutz P.J., Ramillon J.M., Ngonon-Ravache Y., Balanzat E., *Aliphatic/Aromatic Systems under Irradiation: Influence of the Irradiation Temperature and of the Molecular Organization*, Journal of Physical Chemistry B, **2013**, Vol. 117, issue 46, pages 14497-14508

Ferry M., Bessy E., Harris H., Lutz P.J., Ramillon J.M., Ngonon-Ravache Y., Balanzat E., *Irradiation of Ethylene/Styrene Copolymers: Evidence of Sensitization of the Aromatic Moiety As Counterpart of the Radiation Protection Effect*, Journal of Physical Chemistry B, **2012**, Vol. 116, issue 6, pages 1772-1776

Ferry M., Ngonon-Ravache Y., Picq V., Balanzat E., *Irradiation of atactic polystyrene: Linear energy transfer effects*, Journal of Physical Chemistry B, **2008**, Vol. 112, pages 10879-

Ngonon-Ravache Y., Corbin D., Mélot M., Gaté Chr., Balanzat E., *Alkyne creation in aliphatic polymers: Influence of side groups*, Journal of Physical Chemistry B, **2007**, Vol. 111, issue 11, pages 2813-2819

Pennarun P.Y., Ngonon Y., Dole P., et al., *Functional barriers in PET recycled bottles. Part II. Diffusion of pollutants during processing*, Journal of Applied Polymer Science, **2004**, Vol. 92, issue 5: pages 2859-2870

Ngonon-Ravache Y., Foray M-F., Bardet M., *High resolution solid-State C-13- NMR study of As-cured and irradiated epoxy resins*. Polymers for advanced technologies, **2001**, Vol. 12, issue 9, pages 515-523

Ngonon Y., Maréchal Y., *Epoxy-amine reticulates observed by infrared spectrometry. III. Modifications of the structure and hydration abilities after irradiation in a humid atmosphere*. Journal of polymer science part B- Polymer Physics, **2001**, Vol. 39, issue 11, Pages 1129-1136

Ngonon Y., Maréchal Y., *Epoxy-amine reticulates observed by infrared spectrometry. II. Modifications of the structure and hydration abilities after irradiation in a dry atmosphere*. Journal of polymer science part B- Polymer Physics, **2000**, Vol. 38, Issue 2, Pages 329-340

Ngonon Y., Maréchal Y., Mermilliod N., *Epoxy-amine reticulates observed by infrared spectrometry. I. Hydration process and interaction configurations of embedded H₂O molecules*. Journal of physical chemistry B, **1999**, Vol. 103, issue 24, pages 4979-4985

[Articles in conference proceedings](#)

Fremont, Georges; Ngonon-Ravache, Yvette; Schmitt, Christelle; et al. *Preparation of Osmium Targets with Carbon Backing*, proceedings of the 28th world conference of the international nuclear target development society (intds2016). Book Series: AIP Conference Proceedings Volume 1962, **2018**
Article Number: UNSP 030002

Ferry, M., Pellizzi, E., Boughattas, I., Fromentin, E; Dauvois, V; de Combarieu, G., Coignet, P., Cochin F., Ngonon-Ravache Y., Balanzat E., Esnouf S., *Effect of cumulated dose on hydrogen emission from polyethylene irradiated under oxidative atmosphere using gamma rays and ion beams*. Radiation Physics and Chemistry, **2016**, Volume 118, Pages 124-127

Martin, S., Ji, M., Bernard, J., Bredy, R., Concina, B., Allouche, AR., Joblin, C., Ortega, C., Montagne, G., Cassimi, A., Ngonon-Ravache, Y., Chen, L., *Dissociation rate, fluorescence and Infrared radiative cooling rates of Naphthalene studied in electrostatic storage Miniring*, Journal of Physics Conference Series, **2015**, Volume 635, Article Number 032051

Ngonon-Ravache Y. : *Spectroscopic Study of Chemical Modifications Induced by Swift Heavy Ions on Polymers: The Contribution of the CIRIL Platform and the CIMAP Laboratory*, Journal of Physics: Conference Series, **2015**, Vol. 629, Article number: 012006

Chen L., Ortega C., Ji M., Bredy R., Bernard J., Concina B., Montagne G., Joblin C., Cassimi A., Ngono-Ravache Y., Martin S. *Time Evolution of the internal energy distribution of molecules studied in an electrostatic storage ring, the Mini-Ring*. Journal of Physics Conference Series, **2014**, Vol. 488, Article Number: 102011

Dely N., Ngono-Ravache Y., Ramillon JM., et al., *Oxygen consumption in EPDM irradiated under different oxygen pressures and at different LET*, Nuclear Instruments and Method B, **2005**, Vol. 236, pages 145-152

Mélot M., Ngono-Ravache Y., Balanzat E., *Role of the irradiation temperature on the modifications of swift-heavy-ion irradiated polyethylene*, Nuclear Instruments and Method B, **2003**, Vol. 209, pages 205-211

Mélot M., Ngono-Ravache Y., Balanzat E., *Very low temperature irradiation of aliphatic polymers: Role of radical migration on the creation of stable groups*. Nuclear Instruments and Method B, **2003**, Vol. 208, pages 345-352

Technical reports

25 Technical reports (CEA, EDF and REEL), confidential

Other publications

Nov 2007: Article de vulgarisation. Futura-Sciences. Les polymères synthétiques (<http://www.futura-sciences.com/magazines/matiere/infos/dossiers/d/physique-vulgarisation-polymeres-synthetiques-709/>)

Oct 2010 : Article de vulgarisation. Futura-Sciences. Les polymères sous rayonnements ionisants (<http://www.futura-sciences.com/magazines/matiere/infos/dossiers/d/chimie-etude-polymeres-sous-rayonnements-692/>).