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DiSABloC - Directed Self-Assembly of Block Copolymers: Towards Smart Functional Surfaces for Nanoelectronics & Energy

LABORATORIES: LETI, INAC, CERMAV; UNIV. OF CHICAGO/IME & ARGONNE NATIONAL LABORATORY

PRINCIPAL INVESTIGATORS : Paul F. Nealey (Chair of excellence), Raluca Tiron (Grenoble Contact 1), Hammed Gharbi, **Tommaso J. Giammaria** (Postdoctoral Fellow), Patrice Rannou (Grenoble contact 2), Manuel Marechal, Said Sadki, **Gyuha Jo** (Postdoctoral Fellow), Redouane Borsali (Grenoble Contact 3), Sami Halila, Issei Otsuka, Christophe Travelet

Supported jointly by the Labex LANEF and the Grenoble Nanosciences Foundation, the collaborative research project DiSABloC is "high-risk high-gain" (Technology Readiness Level, TRL2-4) and multidisciplinary (chemistry, physics, biology, nano-science/technology). It aims at originally addressing two societal and technological, applied and basic research-oriented grand challenges: i) Ultimate nanoelectronics (ICTs) ii) Safer and more efficient electrochemical energy storage solutions.

At the heart of this project is the disruptive concept of the Directed Self-Assembly (DSA) of a new class of high-χ Block CoPolymers (BCPs), including carbohydrate-based ones. Thanks to 20 years of academic and industrial efforts, this concept is on the verge of achieving goals previously thought as being far

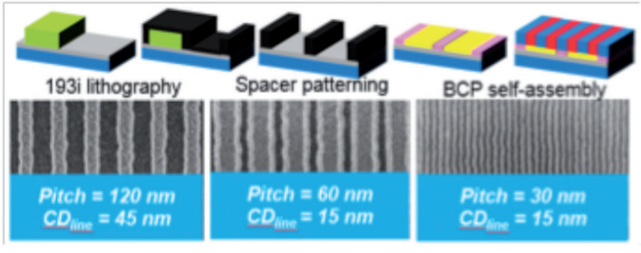

Fig. 1: ICTs: DiSABloC's BCP chemo-epitaxy flow based on spacer patterning leading to 30 nm pitch line patterns

from practical reach: mastering the quasi defect-free ordering of (soft) matter into a handful of morphologies and functions (e.g. nanomasks & ion conductivity) up to the 300 mm wafer scale with pattern resolution down sub-10 nm range.

This unprecedented joint effort to date, co-operated by a leading scientist for Directed Self-Assembly of Block CoPolymers and researchers of three Grenoble labs, is aiming at scientific and technology breakthroughs with transformative economical impacts in

• ICTs/Nanolithography (task 1), through enabling the generation of nanosmasks with sub-10 nm resolution via DSA (grapho/chemo-epitaxy) of BCPs (Fig. 1)

• Energy Storage/Block CoPolymer Electrolytes (task 2), through a fundamental understanding and mastering of the structure/property correlations existing within ion-conducting polymer thin films (Fig. 2)

• Life Sciences (task 3), with smart 2D substrates acting as stimuli responsive test beds for next generation (bio)sensors.

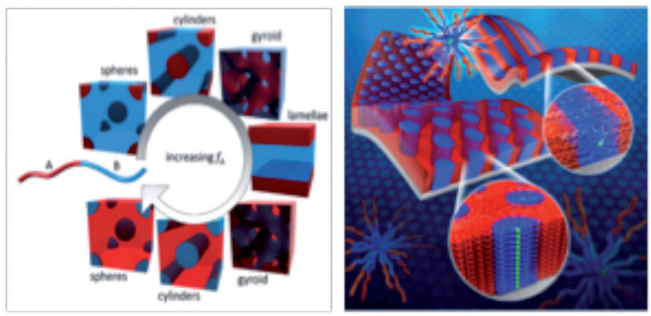

Fig. 2: Electrochemical Energy Storage: Encoding 1D, 2D & 3D ionic transport in DiSABloC's BCP Electrolytes

OUTCOMES

Oral presentations:

ILL-ESRF October 2017;

Bordeaux Polymer Conference, Bordeaux, France, 2018;

E-MRS Spring Meeting, Strasbourg, France, 2018;

4th International symposium on DSA, Sapporo, Japan, 2018.

Collaborations:

O.T. Ikkala, Academy of Finland & Aalto University, Finland. S. Patel, University of Chicago, USA

Awards:

Paul F. Nealey elected to the National Academy of Engineering (USA)