Polymer Derived Ceramics route and derivatives applied to the synthesis of Boron Nitride

Catherine Journet[1]
Boitumelo Matsoso[1], Wenjun Hao[1], Yangdi Li[1,2], Victor Vuillet-a-Ciles[1], Vincent Garnier[2], Philippe Steyer[2], Bérangère Toury[1], Catherine Marichy[1]
1. Laboratoire des Multimatériaux et Interfaces, UMR CNRS 5615, Univ Lyon, Université Claude Bernard Lyon1, F-69622 Villeurbanne, France
2. Université de Lyon, MATEIS, UMR CNRS 5510, INSA-Lyon, F-69621 Villeurbanne cedex, France
catherine.journet@univ-lyon1.fr

Due to its intrinsic properties, hexagonal boron nitride (h-BN) is currently an increasingly attractive material, especially for applications related to two-dimensional materials. However, its properties are highly dependent on the synthesis approach used. The polymer-derived ceramics (PDCs) route allows to elaborate h-BN with adapted textural and structural properties.[1]
Here we will demonstrate the value of the PDCs route for the synthesis of h-BN. First, we will see how the PDCs route alone from borazine precursor allows, at relatively low temperature and atmospheric pressure, the growth of h-BN single crystals with sizes of a few microns. Crystallization is improved by adding 5 wt% Li_3N to the preceramic polymer.
Next, we will show that by coupling the PDCs route with gas pressure sintering (GPS), using the same preceramic polymer and 25 wt% Li_3N, the crystal size is increased to hundreds of microns (figure 1). The resulting pure h-BN single crystals can then be exfoliated into h-BN nanosheets.
Finally, the combination of the PDCs route with atomic layer deposition (ALD) has enabled the successful synthesis of functional BN nano-/heterostructures from highly structured sensitive templates, making this ALD process a promising alternative for the fabrication of functional BN nanostructures.

REFERENCES

[1] B. Matsoso, W. Hao, Y. Li, V. Vuillet-A-Ciles, V. Garnier, P. Steyer, B. Toury, C. Marichy, C. Journet, Journal Of Physics: Materials, 3 (2020) 034002

FIGURES

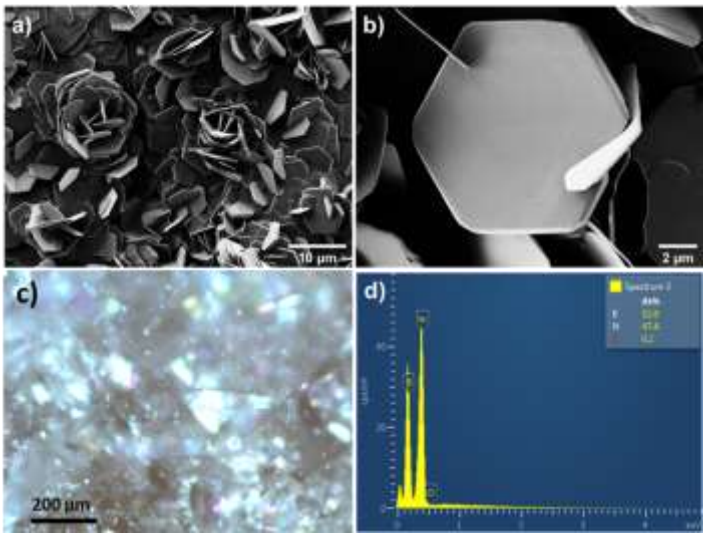

Figure 1: (a), (b) Low resolution SEM micrographs of h-BN sample obtained by the combination of PDCs and GPS. In (a) faceted flower-like crystals are observed and (b) shows the detail of one h-BN crystal. Corresponding (c) optical image and (d) EDS spectrum recorded using SEM.[1]