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PRESS release

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Sylvain Deville, Researcher at one of the Saint-Gobain/CNRS Joint Research Units, awarded Bronze Medal by the CNRS

Sylvain Deville, a researcher in materials sciences at the Saint-Gobain/CNRS Joint Research Unit in Cavaillon (France), was awarded a Bronze Medal by the CNRS French Research Center at a ceremony held at the headquarters of the CNRS Regional Delegation in Marseille (France). This medal, honoring the first work by a researcher and recognizing the person as a talented specialist in his or her field, was given to Sylvain Deville for his research on understanding and controlling the freezing of colloids.

The use of a highly original freeze-dryting method, as a process to structure ceramics, has proven to be extremely interesting as it provides completely new structures controlled at the micrometric scale. Colloids are particles so small that they are unaffected by gravity.

Among the many applications of colloid freezing, its use for obtaining materials inspired from nature seems to be particularly innovative and promising.

For some years now, the design of biomimetic* materials and systems has been the focus of increasing attention. The properties, functions and structures found in nature are increasingly appealing for their potential applications, often arising from complex structures defined at multiple length scales. Applying nature's blueprints to advanced materials could lead to a considerable improvement in their properties compared with current solutions.

Tangible applications of biomimetics are nevertheless surprisingly still rare: the underlying reason being the lack of processing routes to implement the bio-inspired designs into materials and systems. And yet, the message from biology here is clear – there is a need in the design of new materials to develop mechanisms at multiple length scales in order to create new hybrid materials with unique functional properties.

The use of freezing to develop new materials is inspired from the phenomenon of seawater freezing in polar regions. The various natural substances, such as salt and the numerous biological microorganisms originally present in the water are expelled from the water as the ice crystals form. The result consists of a dual structure: channels of brine containing the various microorganisms are formed within the ice crystal scaffold. The idea was therefore to

*Biomimetics is the study of the structure and function of biological systems as models for the design and engineering of materials and processes.

reproduce this process replacing the impurities and microorganisms in seawater with ceramic powders with well-defined characteristics. The final structure is produced by removing the water by sublimation (direct transformation of ice into water vapor, a process commonly used in the food industry).

The result is a porous material with a complex architecture in which the holes are formed by the spaces vacated by the ice crystals. This porous architecture may be infiltrated with a different material to produce a dense composite material. Composites leverage the specific properties of their components: for example, composites can be used to create a material that is both rigid and resistant to the propagation of cracks. Materials made in this way have a striking similarity with the structure of natural mother-of-pearl, the complex architecture of which at various dimensional scales has inspired researchers for many years.

Following engineering degree studies (1997 to 2001) at INSA Lyon (France) and a doctoral thesis (2001 to 2004) at INSA's MATEIS laboratory, on the deterioration mechanisms of zirconia-based biomedical ceramic devices, Sylvain Deville (34 years old), left for the United States for a post-doctoral position (2004 to 2006) at the Materials Sciences Division of the Lawrence Berkeley National Laboratory in Berkeley, California. During these post-doctoral years, he started work on the freezing of colloids and its use to synthesize and form materials that was to become the main focus of his research. At the end of 2006, he was recruited as a research project manager by the CNRS in the Ceramics Synthesis and Functionalization Laboratory at the Saint-Gobain/CNRS Joint Research Unit in Cavaillon (France).

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