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Foreword

Second international symposium *Clays and ceramics for environmental applications*

This thematic issue, entitled *Clays and ceramics for environmental applications*, is dedicated to the second international symposium "Clays and ceramics", organized by the Latvian Clay Science Society held on 29–31 January 2018 in Riga (Latvia).

The aims of the symposium were to promote closer interactions between scientists from different institutes in Baltics to increase their scientific capacity by providing networking opportunities and high-quality lectures from invited colleagues from abroad and to promote the field of clay science among students in natural sciences. All in all, 42 delegates from Latvia, Estonia, Lithuania, Russia, Sweden, Algeria, Tunisia, France, Germany, Cyprus, Spain, and Croatia attended the symposium. Among the participants were present scientists and doctoral students from every local research institute having projects related to clay science. The symposium program was organized in four parts: (1) environmental aspects of clays in geology and modern soils; (2) clay-based composite materials; (3) diffusion, sorption and cation exchange processes involving clay minerals; and (4) clays in archaeology and arts. It can be said that such repartition of presented research, although not done on purpose, represents well the topics developed in clay science in Baltics.

Clay science is indeed an exciting area of research serving as a crossroad between many scientific disciplines. Joint efforts from scientists with different backgrounds in physics, chemistry, geology, agriculture, engineering, and material science have allowed us to advance our understanding of the complexity of clay mineral structure, their reactivity, and numerous possible applications. The continuous improvement in our knowledge of these layered nanomaterials contributes addressing global environmental issues such as wastewater treatment, production of sustainable materials, and application of sustainable agriculture practices. The large diversity of applications of clay minerals and ceramics is represented by the 18 articles selected for this thematic issue.

Such a wide range of applications is possible because of numerous options for clay mineral functionalization or use of a mix of natural clay minerals with distinct properties. Thus, Nabbou et al. [1] and Abidi et al. [2] in their studies suggest that the use of natural North African clay (a mixture of kaolinite and illite) can be more advantageous compared with that of pure kaolinite, because the adsorption of fluoride and red dye RR120 anions onto the samples of natural minerals is higher than that for reference clay samples. Barhoumi et al. [3] explores the potential of the use of local Tunisian clay resources in pelotherapy.

The works of Guégan [4], Solarte et al. [5], Khelifi and Ayari [6], and Guiza et al. [7] describe the improvement in the properties of clays by functionalizing them with organic substances, metal nanoparticles, metal pillars or treating them with acid. Guégan [4] reviews different methods for the preparation of organoclays and discusses their potential as sorbents for wastewater organic contaminants. The functionalization of organoclay makes it possible to change the initial hydrophobic character of the material to a lyophilic one and to confer on it the ability to adsorb aprotic organic molecules. Moreover, the work of Grigale-Sorocina and Birks [8] shows the possibility to apply such organoclays for the stabilization of pigment suspensions. In addition, functionalizing organoclays with silver nanoparticles confers an antibacterial activity on such materials [5]. The material properties can also be enhanced by preparing pillared clays. Thus, Khelifi and Ayari [6] demonstrate that Fe-pillared bentonite has a higher adsorption capacity towards Congo red compared with raw clay. Moreover, the specific use of Fe allowed researchers to apply a photo-Fenton process to degrade the adsorbed organic molecule and hence to regenerate the catalyst. Finally, a clay mineral surface can be increased by applying an acid treatment as reported by Guiza et al. [7], which in turn increases the material's adsorption capacity.

The treatment of clay minerals and oxides at high temperatures leads to the fabrication of different ceramics, which have applications in many sectors. For example, Issaoui and Limousy [9] review the preparation of low-cost ceramic membranes and point to their perspective application in the food and environmental industries. The article

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by Chihi et al. [10] focuses more in detail on the preparation of a membrane from bentonite, whereas the work of Miron et al. [11] explores the possibility of applying a ceramic membrane for the filtration of protein-based solutions. High-temperature treatments allow one to obtain the metal-oxide–based catalysts reviewed by Frikha et al. [12]. Such catalysts can serve as precursors for the fabrication of geopolymers explored in the work of Hamdi et al. [13] or can be successfully applied to CO_2 hydrogenation, as reported by Allam et al. [14].

Finally, it is possible to synthesize new materials inspired by the clay mineral structure. Thus, the research of Miron et al. [15] reports a functionalization of a carbon electrode with a thin film with talc-like structure successfully applied in the electro-Fenton process. The study of Dutournié et al. [16] applies clay-based material for the release of tryptophane, a molecule for plan nutrition in agriculture, and the work of Chaillot et al. [17] reports the synthesis of novel hybrid organic-inorganic saponite-like compounds. New materials from limestone and sewage sludge were also proposed by Pérez-Gimeno et al. [18] for water irrigation treatments.

We would like to express our gratitude to authors who contributed to this thematic issue, as well as to the main partner of the event, the University of Latvia, and especially to Professor Valdis Segliņš for his support in organizing the symposium. The Latvian Clay Group was very honored by the presence of the President of AIPEA, Professor Reiner Dohrmann, and members of the French Clay Group. We thank them for their enthusiasm and support in organizing the Clay meetings in Northern Europe and in preparing this thematic issue devoted to the symposium. The Guest Editors of this thematic issue are thankful to the Editor-in-Chief of the *Comptes rendus Chimie*, Professor Pierre Braunstein, for providing them with an opportunity to publish this thematic issue. Thanks are also due to Mrs. Fatima Messadi and Mrs. Marie Christine Brissot, Editorial and Scientific Secretaries, respectively, and the entire production team of the journal for their valuable support in bringing out this issue. Last but not least, our sincere appreciation is due to all the reviewers for their invaluable and critical comments on the manuscripts that were submitted for this thematic issue.

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Liva Dzene*, Mejdi Jeguirim, Jocelyne Brendlé, Lionel Limousy
Institut de science des matériaux de Mulhouse, France

* Corresponding author.
E-mail addresses: liva.dzene@uha.fr (L. Dzene); mejdi.jeguirim@uha.fr (M. Jeguirim); jocelyne.brendle@uha.fr (J. Brendlé); lionel.limousy@uha.fr (L. Limousy)