

EUROMAT 2019 / Raw Materials

SYMPOSIUM: 7

Title: Synthesis, optimization and characterization through extreme conditions of energy-relevant materials		
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Abstract		
<p>The application of extreme conditions such as high pressure, temperature and irradiation are powerful tools for materials science. Extreme conditions enable a path to local minima in materials' energy landscapes not otherwise accessible. From there, novel kinetically stable materials may be recovered to ambient conditions for future exploitation. Extreme conditions are also a valuable testing tool for the performance of materials in harsh environments such as those commonly found in engines, reactors or in mining engineering. These capabilities have been under-utilized to attend the needs of society for the optimization of raw materials and material feedstocks. This symposium thus aims to address these existing challenges and opportunities.</p> <p>Scalable extreme conditions for materials sciences has attracted much recent interest. For example, computational and experimental efforts have focused on band gap engineering of silicon through high pressure since an optimized silicon state for solar power conversion could replace the use of high-cost raw materials such as gallium arsenide or CIGS. Similarly, high pressure, high temperature processing on carbon precursors aims to synthesize materials harder than diamond itself. Other efforts focus on materials synthesis or optimization where, for example, rare elements can be replaced with less rare counterparts, whereby extreme conditions allow us to overcome kinetic barriers preventing such synthesis otherwise. Specifically, many quantum materials require rare elements in their structure where pressure synthesis could enable a material of same characteristics but made from more common feedstocks. Finally, a key to exploitation of extreme conditions for materials synthesis will be scalable volumes, a topic that will often require novel avenues for application of pressure and other extremes.</p>		