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Pressure-induced phase transitions in nanomaterials: A thermodynamics panorama

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The effects of surface and interface on the thermodynamics of small particles require a deeper understanding. This step is crucial for the development of models that can be used for decision-making support to design nanomaterials with original properties. On the basis of experimental results for phase transitions in compressed nanoparticles, we show the limitations of classical thermodynamics approaches (Gibbs and Landau). We develop a new model based on the Ginzburg–Landau theory that requires the consideration of several terms, such as the interaction between nanoparticles, pressure gradients, defect density, and so on. This phenomenological approach sheds light on the discrepancies in the literature as it identifies several possible parameters that should be taken into account to properly describe the transformations. For the sake of clarity and standardization, we propose an experimental protocol that must be followed during high-pressure investigations of nanoparticles in order to obtain coherent, reliable data that can be used by the scientific community.

Biography

Denis Machon has completed his PhD at the age of 26 years from Grenoble INP and Postdoctoral studies from University College of London. He is now Assistant Professor at University Lyon 1. His research interests are centered on high-pressure physics, thermodynamics and phase transitions. His current research activities are dedicated to the understanding of the combined effects of pressure, size and interface in the phase stability.

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