Editorial

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The experimental determination and the concepts for the calculation of phase diagrams are well established for bulk materials. Both the CALPHAD and the First Principles methods have grown into a science that may be applied to the development of materials processing. The *JPED* is clear proof of this achievement. Yet our knowledge of phase diagrams seems to be just a small dust particle when confronted to the growing field of nanomaterials, with their sizes ranging from a few nanometers up to 200 nm.

Despite the growing number of publications in this field, very few are related to phase diagrams. A bibliography research using the keywords *nanomaterials* and *phase diagram* within the SCOPUS database shows an interesting trend. From 1997 to the end of 2007, the number of articles (23) that included these two words is much smaller than the number of patents (464). This is evidence that most research is related to the processes that produce the nanomaterials and aim for profit, even if not funded by the private industry. Most articles and patents appeared after 2003, and their numbers are growing each year, in particular, the patents.

Phase diagrams for nanomaterials systems pose some interesting problems to the experimentalist and the theorist. Is it really meaningful to obtain a phase diagram for a nanomaterial system, where a significant fraction of the material can be at the interfaces? It is important to remember that the interfacial energy is usually ignored in determining phase diagrams. Further, the structures observed in nanomaterials depend strongly on the processing conditions, which may alter both the morphology and the crystallography of the forming phases. Do we have to include some sort of size scale in the phase diagram? It is well known from thermodynamics that small particle sizes, or small surface curvatures, change the chemical potential. What is the smallest size of particle that will still allow us to define a meaningful phase diagram? We can certainly come across many other questions related to this fascinating field and we will look forward to discuss them in this Journal.

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