Condensed Matter > Materials Science

Impact of intrinsic localized modes of atomic motion on materials properties

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(Submitted on 26 Jan 2010)

Recent neutron and x-ray scattering measurements show intrinsic localized modes (ILMs) in metallic uranium and ionic sodium iodide. Here, the role ILMs play in the behavior of these materials is examined. With the thermal activation of ILMs, thermal expansion is enhanced, made more anisotropic, and, at a microscopic level, becomes inhomogeneous. Interstitial diffusion, ionic conductivity, the annealing rate of radiation damage, and void growth are all influenced by ILMs. The lattice thermal conductivity is suppressed above the ILM activation temperature while no impact is observed in the electrical conductivity. This complement of transport properties suggests that ILMs could improve thermoelectric performance. Ramifications also include thermal ratcheting, a transition from brittle to ductile fracture, and possibly a phase transformation in uranium.

Comments:	34 pages, 11 figures, to appear in Acta Materialia
Subjects:	**Materials Science (cond-mat.mtrl-sci)**; Pattern Formation and Solitons (nlin.PS)
DOI:	10.1016/j.actamat.2010.01.021
Report number:	LLNL-JRNL-422804
Cite as:	**arXiv:1001.4583v1 [cond-mat.mtrl-sci]**

Submission history

From: Michael Manley [view email]
[v1] Tue, 26 Jan 2010 02:26:52 GMT (2534kb)

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