

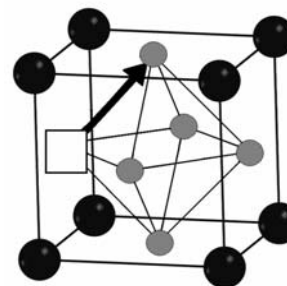
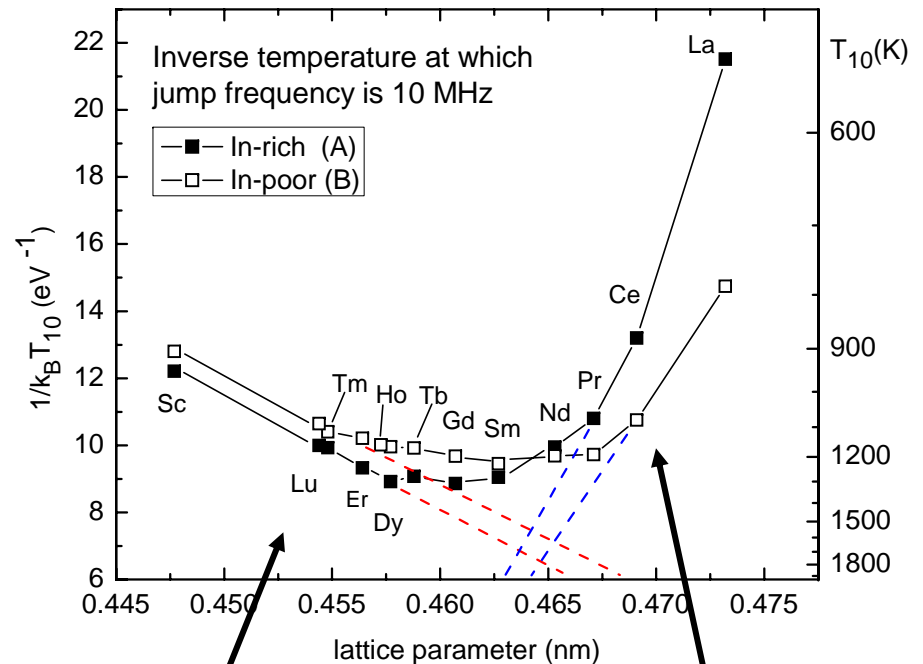
New insight into diffusion mechanisms in compounds

Gary S. Collins (Washington State Univ.), DMR-0504843

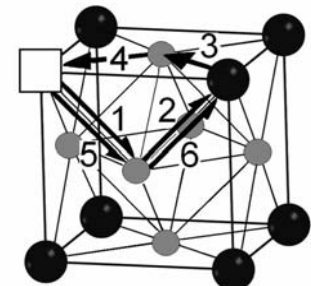
Professor Collins and group are using *PAC* spectroscopy to determine jump frequencies of probe atoms in solids. The jumps are into neighboring vacancies (empty sites). Here, they measured jump frequencies for the complete series of rare-earth triindides having the Cu_3Au crystal structure (see diagrams). They made measurements at slightly In-rich and In-poor boundary compositions.

The graph shows that jump frequencies were greater for In-rich indides of light lanthanides (La,Ce,Pr,Nd) but greater for In-poor indides of the rest. However, vacancy concentrations can only vary monotonically with composition, so that diffusion occurs mostly via rare-earth vacancies in the light lanthanides and via indium vacancies for the rest, with the most likely mechanisms shown below the graph.

Thus, measuring jump frequencies at two compositions gives a new method to identify dominant diffusion mechanisms in compounds. Moreover, the graph shows a remarkable change in mechanism in this series of rare-earth indides.



Simple indium sublattice vacancy mechanism



Six-jump cycle for rare-earth vacancy

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Group photo August 2008: grad students Randal Newhouse and John Bevington, REU student Megan Lockwood and friend, and Matt Zacate, Adjunct Professor



Group photo July 2009: me, HS student Prastuti Singh, Matt, John, Randy and REU student Samantha Cawthorne.

Broader Impacts since summer 2008

New method to provide insight into diffusion mechanisms (previous page)

Student training: (three women)

Two graduate students

Two undergraduate REU students

One high school student

Presentations at international diffusion conference, Canary Islands, Oct 2008; other minor presentations

Visits to five European labs while on leave in Fall 2008, with talks

Established collaboration for future experiments at ISOLDE, CERN. Attended user's workshop for ISOLDE.

Inauguration of electronic structure calculations using WIEN2k to help interpret experiments

<http://defects.physics.wsu.edu>