Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

High hardness and superlative oxidation resistance in a pseudo-icosahehdral Cr-Al binary J. W. SIMONSON, R. ROSA, A. K. ANTONACCI, Department of Physics, Farmingdale State College, H. HE, Department of Physics and Astronomy, Stony Brook University, A. D. BENDER, J. PABLA, W. ADRIP, Department of Physics, Farmingdale State College, D. E. MCNALLY, A. ZEBRO, P. KAMENOV, G. GESCHWIND, Department of Physics and Astronomy, Stony Brook University, S. GHOSE, E. DOORYHEE, National Synchrotron Light Source II, Brookhaven National Laboratory, A. IBRAHIM, Department of Mechanical Engineering Technology, Farmingdale State College, M. C. ARONSON, Department of Physics and Astronomy, Stony Brook University — Improving the efficiency of fossil fuel plants is a practical option for decreasing carbon dioxide emissions from electrical power generation. Present limits on the operating temperatures of exposed steel components, however, restrict steam temperatures and therefore energy efficiency. Even as a new generation of creep-resistant, high strength steels retain long term structural stability to temperatures as high as ~ 973 K, the low Cr-content of these alloys hinders their oxidation resistance, necessitating the development of new corrosion resistant coatings. We report here the nearly ideal properties of potential coating material $Cr_{55}Al_{229}$, which exhibits high hardness at room temperature as well as low thermal conductivity and superlative oxidation resistance at 973 K, with an oxidation rate at least three times smaller than those of benchmark materials. These properties originate from a pseudo-icosahedral crystal structure, suggesting new criteria for future research.

Jack Simonson
Farmingdale State College

Date submitted: 05 Nov 2015

Electronic form version 1.4