Dramatic Compositional Effects on Transport in Concentrated Solid Solution Alloys

Scientific Achievement

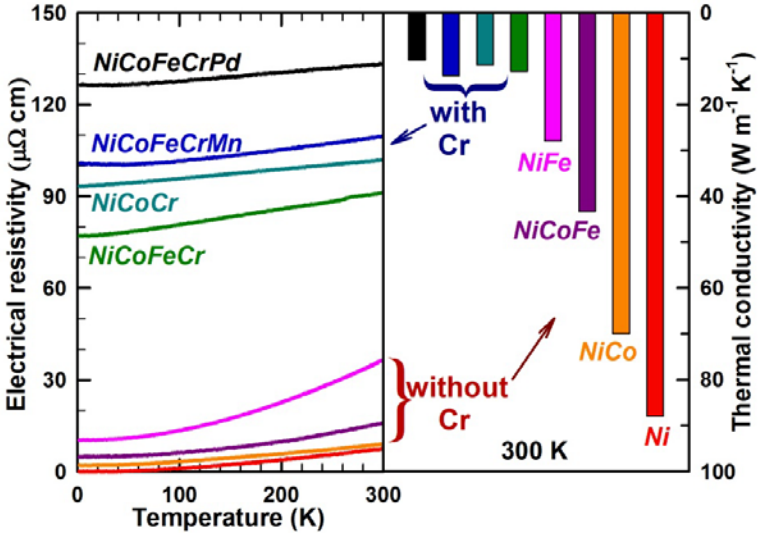
Extreme disorder induced by compositional complexity is found to strongly affect the electrical, thermal, and magnetic properties in Ni-containing FCC equiatomic alloys.

Significance and Impact

Tuning the physical properties in concentrated alloys can be achieved by modifying electronic and magnetic structures through varying number and type of alloying elements.

Research Details

- Ni-containing FCC equiatomic alloys, from binary to quinary, were synthesized, and their transport properties were measured.
- Alloying with Cr significantly enhances the scattering of electrons, hinders the thermal transport, and reduces the magnetization.
- Electronic structure calculations revealed that the magnetic disorder plays a critical role in transport properties.



The electrical resistivity and thermal conductivity are strongly affected by the alloying composition, e.g., the addition of Cr, rather than only by the number of alloying elements.

K. Jin, B. C. Sales, G. M. Stocks, G. D. Samolyuk, M. Daene, W. J. Weber, Y. Zhang, and H. Bei, "Tailoring the physical properties of Ni-based single-phase equiatomic alloys by modifying the chemical complexity" Sci. Rep. 6, 20159 (2016). DOI: 10.1038/srep20159.