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Exploration of an electron work function - based strategy for tailoring materials

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Properties of materials are fundamentally dependent on their electron state, which is largely reflected by the electron work function (EWF). A higher work function corresponds to a more stable electronic state with a higher resistance to any attempt of changing the state or related states of a material, such as crystal structure or microstructure caused by mechanical and electrochemical processes. In this talk, close correlation between EWF and material properties will be demonstrated. With this simple characteristic parameter, many material intrinsic properties and processes could be analyzed without involving complex theoretical treatments. Particular attention will be put on the possibility of using EWF as a fundamental parameter for material design, which provides information or clues in a simple or straightforward way for material modification and development. Using Cu-Ni alloy as an example, the correlation between the electron work function (EWF) and mechanical and tribological properties will be demonstrated. One may see that properties of the alloy vary with the electron work function when composition changes, implying that properties of a material can be modified using elements with appropriate work functions. This should also be applicable for tailoring inter-phase boundaries or interfaces.

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