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## **ABSTRACT:**

### Vacancy Diffusion Barrier Spectrum and Diffusion Correlation in Multicomponent Alloys

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Vacancy diffusion serves a crucial role in many important kinetic behaviors and properties of multicomponent alloys. Essential questions, however, persist regarding how chemical complexity affects diffusion and what unique characteristics, if any, set these alloys apart from traditional metals. Using a neural network kinetics model, we study vacancy diffusion in NbMoTa alloy across a broad temperature range. Unlike pure metals, the two key diffusion parameters, diffusion correlation factor and activation energy, are not constant in alloys, but instead substantially decrease with decreasing temperature. This temperature dependence arises from a reduced number of active vacancy jump pathways at lower temperatures, leading to more correlated diffusion. The diffusion barrier spectrum, which characterizes the diffusion energy landscape, is an intrinsic material characteristic that controls both diffusion correlation and diffusion activation energy, and thereby the diffusivity.