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# Dislocation binding as an origin for the improvement of room temperature ductility in Mg alloys

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## Abstract

Improving room temperature ductility and formability is a bottleneck for a wide industrial application of Mg alloys, but even the mechanism for the effect of alloying elements on the deformation behavior of Mg is not clearly known. Here, using a molecular dynamics simulation, we clarify the role of alloying elements in improving the room temperature ductility of Mg alloys: Solute atoms have stronger dislocation binding tendency and solid solution strengthening effect on basal  $\langle a \rangle$  slip planes than on non-basal  $\langle c+a \rangle$  slip planes, reduce the anisotropy in the critical resolved shear stress between slip systems, and eventually improves the room temperature ductility. We predict that any solute elements with a size difference from Mg can improve the room temperature ductility, once the alloying amount is carefully controlled. By proving the validity of the prediction experimentally, we provide a new guide for designing Mg alloys with improved room temperature ductility and formability.

+ Equal contribution

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