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Interface toughness affected by mode mixity and interface chemistry

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Microelectronics applications require combinations of various materials in stacked layers or structured components in order to ensure the functional performance of the final component. Typically, rather ductile phases such as Cu are joined with very stiff diffusion barrier layers such as WTi and thermos-mechanically loaded in a complex fashion. Thereby, the different material properties and incompatibilities could lead to failure. In order to address this problem, as well as the potential influence of interface segregation on the interface properties, we conducted miniaturized in-situ SEM fracture experiments in Mode I and Mode II employing conventional SEM as well as transmission-SEM imaging. Combined with insights from ab-initio calculations we are able to detail the influence of O segregation to the interface [1] as well as mode mixity [2] on the failure characteristic of this model microelectronic interface.

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References:

[1] M. Alfreider et al, The influence of chemistry on the interface toughness in a WTi-Cu system, under review, 2022.
[2] M. Alfreider et al., Interface mediated deformation and fracture of an elastic-plastic bimaterial system resolved by in situ transmission scanning electron microscopy, under review, 2022.