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LETTER

An empirical scaling model for averaging elastic properties including interfacial effects

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ABSTRACT

The elastic properties of ceramics and a mix of minerals can be calculated in a simple way including some properties of the interfaces between grains. While the Hashin Shtrikman averaging method has bounds, which are strictly correct for many realistic physical conditions, one finds empirical data which lie outside these bounds. One possible interpretation is that the scaling of the volume proportions in mineral assemblies is not truly represented by the nominal volume proportion f of each phase. It is argued that interfacial effects scale with $f(1-f)$. In the case of certain assemblies, it is shown that the scaling is entirely with f^2 rather than f . For intermediate cases, a more realistic scaling replaces f in the relevant averaging schemes by $f(1-S) + Sf^2$ where S weighs the effect of the non-linearities in the volume expansion of the averaging schemes.

Keywords: Compressibility, mechanical properties, elastic moduli, surfaces