## Elasticity and Strength of Nano-Fiber Reinforced Composites from First Principles

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Calculations of elastic moduli and theoretical uniaxial strength of unidirectional composite having continuous nano-fiber reinforcements are performed using ab initio method. Study of tungsten nano-fibers in vanadium matrix are presented as a particular example of the analysis. Obtained results are used to verify validity of macro-scale empirical relations for composites (rules of mixtures) on the nano-scale.

The dependences of the computed composite elastic moduli on the atomic concentration of tungsten are compared with a simple rule of mixture for an ideal composite. Results show that validity of the linear mixture rule is theoretically justified for most of them. On the other hand, computed values of the theoretical tensile strength exhibit a simple increasing dependence up to 70% concentration. Then the values become saturated or even slightly decrease.