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NANOINDENTATION: DETERMINING THE SIZE OF THE PLASTIC ZONE BY MOLECULAR DYNAMICS SIMULATIONS

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Abstract. Nanoindentation creates permanenent defects (plasticity) by removing atoms irreversibly from their lattice sites. The size of the plastic zone is known to be proportional to the contact radius of the indenter with a proportionality factor f. Since the correction method introduced by Durst et al. [ScriptaMater2005] for adjusting the Nix/Gao model for indentation size effect, the plasticity zone factor f has been used widely but without a systematic analysis on what value should be given to it depending on the size of the indenter, its penetration rate, temperature or the crystallographic structure of the sample. In this study we make use of the molecular dynamics technique to study the extent of the plasticity zone for various indenter diameters, varying temperature and penetration rate for a variety of metals, both fcc (Al, Cu) and bcc (Ta, Fe).