MULTISCALE MODELLING OF REPEATED IMPACTS: CASE OF ULTRASONIC SHOT PEENING

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Ultrasonic Shot Peening (USP) is a cold surface treatment used to improve the fatigue life of metallic components [1]. Residual stress induced by thousands of impacts was one of the origins of fatigue strength improvement. It appears that the process reliability strongly depends on speed and angle of the impacts [2].

Despite of these results, only few numerical studies taking into account microstructure were performed, whereas finite element using crystal plasticity law would complete the understanding of process effects [3,4]. For this purpose, we propose a multiscale modelling of USP: at the process scale, DEM simulations provide the characteristics of the impacts (angle and velocity); at the impact scale, FEM simulations provide access to the geometry of the imprint and finally, at the grain scale, the FEM simulations using crystal plasticity law [5] make it possible to analyse the microstructure changes under impacts and then to study their efficiency according to the angle of impact. Our results show that oblique impacts strongly affect the microstructure in surface. So, the next step will be the analysis of the effect of different successive angles of impact.

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