8th. World Congress on Computational Mechanics (WCCM8)
5th. European Congress on Computational Methods in Applied Sciences and Engineering (ECCOMAS 2008)
June 30 – July 5, 2008
Venice, Italy

Size effect in a cellular automata model for systems of interacting dislocations

***Valentina Beato[1], Stefano Zapperi[2]**

[1] ISC-CNR
via dei Taurini 19
00185 Roma, Italy
valentina.beato@roma1.infn.it

[2] CNR-INFM, S3,
Dipartimento di Fisica
Universita' di Modena e Reggio Emilia
via Campi 213/A,
I-41100 Modena, Italy
stefano.zapperi@unimore.it

Key Words: *Dislocations, Plasticity, Size Effect.*

ABSTRACT

Recent experimental and theoretical works [1,2,3] show that plastic deformation in microcrystals is accompanied by strain bursts caused by dislocation avalanches. Moreover it has been shown that these samples display interesting size effects [4] whose underlying mechanism is still not completely understood. Here we present a minimal cellular automaton model for dislocation dynamics which includes long-range stresses, dislocation annihilation and multiplication. We compute the yield stress distributions, their dependence on the sample size and the distribution of the burst size during tension tests. The numerical results are compared with experiments.

REFERENCES

[1] D. M. Dimiduk,C. Woodward, R. LeSar, M.D. Uchic, "Scale-Free Intermittent Flow in Crystal Plasticity", *Science,* Vol. **312**, 1188- 1190, (2006).

[2] F. F. Csikor, C. Motz, D. Weygand, M. Zaiser, S. Zapperi, "Dislocation Avalanches, Strain Bursts, and the Problem of Plastic Forming at the Micrometer Scale", *Science,* Vol. **318**, 251 - 254, (2007).

[3] M. Zaiser, "Scale invariance in plastic flow of crystalline solids", *Advances in Physics* , Vol. **54**, 185-245, (2006).

[4] M. D. Uchic, D. M. Dimiduk, J. N. Florando, W. D. Nix, "Sample Dimensions Influence Strength and Crystal Plasticity", *Science, Vol.* **305**, 986-989, (2004).