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# SEMINAIRE

## Service de Recherches de Métallurgie Physique

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# *Dislocation dynamics : from micro to mesoscale description*

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Investigation of the dynamic behavior of dislocations, the carriers of plastic deformation attracts growing interest because of its importance for understanding many properties of plastically deformed crystalline materials, closely related to the dislocation patterning and dynamic properties of dislocation motion.

The mechanical properties of alloys that are candidate materials for heat exchangers, turbine blades, or gas cooled reactors (currently studied in the Generation IV program), operating at high temperatures under extreme loading conditions degrade with time. The general degradation mechanisms of materials include time-dependent deformation, microstructural and compositional changes, corrosion enhanced by the accelerating effects of elevated temperatures, etc. High-speed rotating components are susceptible to component failure due to bearing wear and vibration, failure due to low cycle fatigue (the fatigue of rotating components brought on by the continuous imposing and relaxing of centrifugal force caused by fluctuation in speed or by thermally induced strains).

The influence of dislocation climb during low cycle fatigue on the pattern formation is explored in the simplest possible multislip model where a system of straight, parallel edge dislocations is considered. First we revisit the continuum dislocation dynamics method based on coarse graining technique then simulation results on our oversimplified model are presented.(with and without climb mobility) and compared. The main result is that in presence of climb cellular structures with well defined characteristic length emerge in contrast to the self-similar (fractal) dislocation patterns developing under similar deformation conditions in absence of climb. The cell structure emerging when climb is not negligible resembles the dislocation patterns seen in thermal recovery or melt-grown experiments.

Dispersoid strengthening is particularly important for ferritic based structural components used in nuclear applications due to their superior radiation resistance and creep strength at high temperatures. In oxide dispersion strengthened steels the interactions between dispersoids and dislocations determine the material's plasticity. The plastic flow is determined by the motion of dislocations interacting with each other and with the dispersoids. The effect of dispersoids on the motion of dislocations is presented through Discrete Dislocation Dynamics simulations.

## Jeudi 2 octobre 2008 à 10h30

***N.B :*** *Les visiteurs de nationalité étrangère hors Union Européenne sont priés de bien vouloir avertir impérativement 3 semaines à l'avance – les visiteurs de l'Union Européenne 1 ou 2 jours avant le séminaire – le Secrétariat du Service de leur entrée sur le Centre :*
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