Symposium | A. Advances in Materials Theory for Multiscale Modeling

[SY-A7]Symposium A-7

Chair: Michael Zaiser(FAU University of Erlangen-Nuremberg, Germany)

2018年10月31日(水) 14:00 ～ 15:30 Room6

[SY-A7]2D continuum theory of dislocations

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During the past 20 years, by a systematic course graining of the equation of motion of straight parallel edge dislocations a 2D continuum theory of dislocation has been developed. It is able to account for many important feature of the collective properties of dislocations, like size effect, hardening due to precipitates, dislocation density distribution next to boundaries, and dislocation patterning. The predictions of the theory are directly compared to discrete dislocation dynamics simulations.

In spite of the success of the theory there are several open issues need to be addressed for further developing the current theory. In the talk the problems "blocking" the extension of the theory are discussed:

1. Do we need a continuum theory?

2. Why still in 2D? What we can learn from it?

3. Should we course grain the equations of motion of the dislocations or the energy of the discrete system to derive the continuum theory?

3. Numerical determination of the dislocation dislocation correlation function. Problems related to the the finite size effect observed.

4. What to do next to boundaries?

5. Phase field approach. Issues related to the nontrivial mobility function one has to introduce.

6. Slow, power law relaxation of the dislocation system.

7. How to incorporate stochastic effects.