

# Seminar on Condensed Matter Theory

Group of Theoretical Physics at the Department of Condensed Matter Physics  
of Charles University has a pleasure to invite you to attend the seminar

**on 6 December 2018 at 13:00**

at Faculty of Mathematics and Physics of Charles University, Ke Karlovu 5, 121 16 Praha 2

**Seminar room F052**



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## Nano-to-meso scale study of mechanical properties of Fe-Al-based superalloys

Fe-Al-based ferritic superalloy nanocomposites containing sub-micron cuboids of intermetallic phases coherently embedded into a disordered Fe-Al solid solution are intensively studied as candidate materials for high-temperature applications. We focused on Fe-Al-based superalloys containing Ti [1,2] and Co [3] as ternary elements as well as Fe-Al binary nanocomposites [4]. The transmission electron microscopy (TEM) revealed a superalloy nano-structure in these materials and the energy-dispersive X-ray (EDX) technique detected the composition of individual phases. Subsequently, quantum-mechanical calculations were used to determine thermodynamic, elastic and magnetic properties of constituting phases as well as selected nanocomposites [4]. In particular, the theoretically predicted significant differences in the elastic response of different phases were confirmed also experimentally by room-temperature quasistatic nano-/micro-indentation and nano-scale dynamic mechanical analysis (nanoDMA). Regarding high-temperature macro-scale measurements, small-punch testing was performed and showed improved creep properties of the studied materials when compared with binary Fe-Al.

[1] M. Friák, A. Slávik, I. Miháliková, D. Holec, M. Všianská, M. Šob, M. Palm, J. Neugebauer, *Materials* 11 (2018) 1732.

[2] Y. Jirásková, N. Pizúrová, A. Titov, D. Janičkovič, M. Friák, *Journal of Magnetism and Magnetic Materials* 468 (2018) 91.

[3] M. Friák, S. Oweisová, J. Pavlů, D. Holec, M. Šob, *Materials* 11 (2018) 1543.

[4] P. Šesták, M. Friák, D. Holec, M. Všianská and M. Šob, *Nanomaterials* 8 (2018) in press.

