MONASH University

Monash Centre for Electron Microscopy

Seminar

Precipitation in age hardenable Al alloys -studied at the nanoscale

WEDNESDAY 27 NOVEMBER, 2019

2.00PM

SCIENCE LECTURE THEATRE S1

16 Rainforest Walk, Monash Clayton Campus

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Abstract

Age-hardenable aluminium – 2xxx, 6xxx and 7xxx – alloys are important structural materials for construction and automotive applications due to properties like high strength/weight ratio and good formability, often combined with good corrosion resistance. Chemical composition and thermo-mechanical history of the alloy will to a large extent decide its physical properties. Our overall objective is to improve the understanding of the fundamental physics taking place at the atomic scale in these alloys – which decides clustering, nucleation, phase stabilization and precipitation [1]. If we are able to map the atomic structure of clusters and precipitates and predict how they develop, we can design new or optimize chemical compositions of existing alloys to get desired properties for given applications. Our research group at NTNU and SINTEF in Trondheim, has over a long period worked together with the Norwegian light metal industry on nanoscale studies of these alloys. Combining several advanced (scanning) transmission electron microscopy ((S)TEM) techniques, including scanning precession electron diffraction (SPED) with density functional theory (DFT) calculations, early stages of clustering, nucleation and precipitate evolution are studied. This talk will present some of the last results we have obtained on nanoscale studies of precipitates [2].

The TEM work was conducted using the NORTEM infrastructure (NFR 197405) at the TEM Gemini Centre, Trondheim, Norway.

[1] SJ Andersen et al. Advances in Physics: X 3:1 (2018) 1479984; T Saito et al. Adv. Eng. Mater. (2018) 1800125
[2] JK Sunde et al. Mater. Charact. 142 (2018) 458; E Christiansen et al. Mater. Charact. 144 (2018) 522; E Thronsen et al. Materials & Design (2019) in press.

The Presenter

Dr. Holmestad is professor at Dept. of Physics NTNU (since 99). Degrees: Dr. ing. (PhD) in materials physics, NTH, 1994, Siv. ing (MSc) in technical physics, NTH, 1991. Holmestad's present research interests are focussed on materials physics; transmission electron diffraction and microscopy (TEM), materials microstructure and the relation to macroscopic properties. Ongoing projects are on aluminium alloys, solar cell materials, electron diffraction and new functional materials. She has initiated and been project leader for several externally funded projects over the past fifteen years, funded mainly by the Norwegian Research Council and Hydro Aluminium. The main research projects she have been involved in are *Quantitative convergent beam electron diffraction* (2000-03), the SUP *Micro- and nanostructural materials development* (2001-06), the NorLight project *Heat treatment fundamentals* (2001-07), the Industry initiated project *Nucleation control for optimised properties* (2007-12), the FRINAT project *Fundamental investigations of clustering* (2007-11), the *Japanese-Norwegian Al-Mg-Si precipitation project* (2009-14 and 2019-2022), the FRINATEK project *Fundamental investigations of precipitation in the solid state with focus on Al-based alloys* (2013-17), the KPN project *Fundamentals of intergranualr corrosion –FICAL* (2017-2021) and last the KPN project *Solute cluster manipulation for optimized properties in Al-Mg-Si based Al alloys (SumAl)(2019-2024)*. In addition she has been leader of TEM Gemini Centre (SINTEF, NTNU) 2006, 2008-2013*, and l*eader for a Nordic network within TEM in Nordforsk, *NorTEMnet*, 2010-2014. She was the project leader of *NORTEM, Norwegian Centre of transmission electron microscopy,* 2010-2013, 2017- >) a large scale infrastructure project in TEM, from SINTEF, UiO and NTNU (total project 115 MNOK, 2011-20). Since 2015 she is involved in the SFI project CASA, Centre of advanced structural analysis.

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