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Hald, John

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High Temperature Materials for Efficient, Flexible Thermal Energy Plants

John Hald

DTU Mechanical Engineering

jhald@mek.dtu.dk

Abstract

Traditional fossil-fired thermal power plants are challenged in regions like Denmark and Germany, where renewable energy technologies such as wind and PV are introduced in large scale. Due to priority for wind and PV in the grid, their production time is limited, which is an economic challenge. Due to fluctuating output from wind and PV they have to operate with highly flexible output, which increases fatigue loads on sensitive components designed for more steady operation modes.

In Denmark, the strategy for existing thermal power plants involves replacement of fossil fuels with biomass like straw and wood, which are considered CO_2-neutral. However, the biomass contains highly aggressive species, which introduce accelerated corrosion in heat exchangers and limit efficiency and lifetime.

On the global scale, Thermal power from coal and gas provide 65% of electricity production, and many scenarios predict that this share could remain almost constant in the next 25 years[1]. This means that we have never had as many coal and gas fired power plants in the world as we have now, and that they will most likely be more numerous in coming decades. Efficiency increases of thermal power by a few percentage points can lead to savings in the order of Gigatonnes of CO_2 emissions on the global scale[2].

The lecture describes research to develop and introduce stronger and more corrosion resistant high temperature materials and surface coatings for critical components of thermal power plants. Such materials can lead to improved efficiency and flexibility, longer lifetimes and reduced emissions.

[1] Eia, US Energy Information Administration, “International Energy Outlook 2013” DOE/EIA -0484(2013)

[2]IEA, International Energy Agency, Technology Roadmap “High-Efficieny Low-Emissions Coal Fired Power Generation” OEDC/IEA 2012