

# Editorial

## Thermal Spraying in Europe's Nordic Region



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The European Nordic countries consist of Finland, Sweden, Norway, Denmark, and Iceland and, together, have a total population of approximately 24 million. The high level of education, in conjunction with a long industrial tradition, makes the region well suited for the development and use of thermal spraying. The market for thermal spraying has grown continuously over the last three decades. Important application areas are pulp and paper manufacture, the automotive industry, aerospace, off-shore oil drilling, and the shipyard industry. Thus, taking the region as a whole, the applications for thermal spraying are extremely diversified.

In Sweden, aero engines and industrial gas turbines are important thermal spraying applications; the Volvo Aero Corporation and Siemens Turbomachinery are the major industries. Thermal barriers, wear protection, and abradable coatings dominate this sector, where the aim is to improve gas turbine efficiency and reduce emissions. The cutting edge of high-tech thermal spraying in Sweden is to be found at Volvo Aero Corp., in the manufacture of components for the European Space Program. Other industrial sectors in Sweden where thermal spraying plays an important role are automotive industry (Daros Piston Rings AB) and paper industry (Metso Paper AB). Höganäs AB is one of the world's leading companies in manufacturing metallic powders for thermal spraying.

In Norway, thermal spraying is a well-established technology for applying wear- and corrosion-resistant coatings, mainly in the petrochemical and offshore industries such as for Scana Offshore Vestby AS. The high-velocity oxyfuel (HVOF) spray process is being increasingly used to improve the antierosion and anticorrosion properties of different components.

In Finland, pulp and paper applications are the dominant sectors for thermal spraying. This industrial sector in Finland has meant that the use of thermal spraying has become very important, and the number of companies using thermal spraying materials and indeed the level of international cooperation, are all greater in Finland than in any of the other Nordic countries. Companies such as Metso Paper Inc., Pikoteknik Oy, and AK-Tehdas Oy are the most important players in this sector. Among Metso Paper's many products, the ceramic-coated center press rolls for replacing granite rolls are good examples of the ways in which thermal spray processes are used. Another example of products used in paper machines are thermal spray coated drying cylinders, which are often coated on-site. The Pikoteknik Company has a worldwide reputation in this business area with their own specially developed surfaces.

In Denmark, a major application area is the shipyard industry, where thermal spraying is used for diesel engines for industries as MAN Diesel A/S. Another Danish application area is wear-resistant coatings for machine and tool parts.

In the Nordic region, Finland and Sweden dominate the research conducted in thermal spray technology, followed by Denmark and Norway. The most prominent research teams are to be found at University West in Sweden, Tampere University of Technology and VTT in Finland, Force Technology in Denmark, and SINTEF in Norway. The work carried out ranges from the development of three-dimensional simulation models of flame and plasma spraying, including particle impact phenomena, to the development and use of measurements and diagnostic systems for particle in-flight and splat characterization. Most recently, thermal spraying in combination with laser treatment has received increasing attention. Fundamental research concerning the

development of new materials, such as nanocomposite coatings, is pursued, as well as more applied research for increased functional coating performance and production reproducibility. Research on cold sprayed coatings has been a prominent area of interest during recent years. In addition, research at Tampere University of Technology has led to spin-off companies, examples of which are Millidyne Surface Technologies, which manufactures ceramic powders and tailored sealants, and Oseir, which is operative in the field of thermal spray process monitors.

In terms of societal activities, the Swedish Welding Commission has a working group for thermal spraying that meets twice a year. From time to time, members from Denmark, Finland, and Norway are invited to join this group. Conferences are also held regularly. One example is the Nordic conference on thermal spraying that is held every third year, the most recent being in Trollhättan, Sweden, in September 2006. The Thermal Spray Club has recently been started in Finland with the aim of enhancing the image of thermal spraying. European Thermal Spray (ETS) operator training has been conducted for a number of years in both Sweden and Finland.

In this issue of JTST, papers originating from two of the Nordic European countries are included. While the papers are not fully representative of the work carried out at the different labs, they do however present a representative sample of ongoing research, ranging in scope from modeling and simulation to splat characterization and the metallographic evaluation of deposited materials. A Commentary paper is also provided, giving more details on thermal spray activities in the Nordic region.

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