

Spectral emissivities of metals dependent on heat-treating processes.

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The Gerhard-Mercator-University Duisburg operates special measurement instrumentation for the determination of spectral emissivities of metals. Experimentation is conducted in the wavelength range between 0,6 μ m and 16 μ m and the temperature range 200°C and 1200°C. This covers the typical range for the heat transfer by radiation in industrial furnaces, especially heat treatment furnaces.

During the heat treatment, the surface layer of the metals undergoes a thermo-chemical change. The absorption properties of the metal before and after the heat treatment are examined in relationship to the treatment processes, temperatures and atmospheres, including vacuum. The samples are heat-treated in industrial heat treatment furnaces. The determination of the spectral absorption properties results from the measurements of emissivity by applying Kirchhoff's law. Heat treatment is conducted in a protective gas atmosphere, e.g., H₂, N₂, etc. It is necessary for the measurements in the laboratory to use the same protective gases, which have to be mixed from cylinder gases. For the analysis in other heat treatment atmospheres such as endogas or exogas the protective gas equipment in the lab has to be expanded.

The surfaces of the samples are analyzed before and after the heat treatment and emissivity measurements. The surface condition (general description of the surface), the structure (metallurgical polished layers), the surface roughness and the chemical composition (with Glow Discharge Optical Spectroscopy [GDOS]) are analyzed. Preliminary results of the measured emissivities are presented.