

Spectroscopic Approach to Thermal Radiation Phenomena of Surfaces with Application to In-process Surface Diagnosis

Toshiro Makino ^{C,S}

Department of Engineering Physics and Mechanics, Kyoto University, Kyoto, Japan

Solid surfaces in industrial processes are being changed their microstates. Thermal radiation characteristics of such surfaces are sensitive to the microstates, and can change dynamically with the change in the surface states. In the thermal radiation characteristic study of such surfaces for heat transfer science and/or pyrometry, a new approach is required besides that for the universal properties of clean, optically smooth and flat surfaces in laboratories of physics or chemistry. In this talk, we introduce our spectroscopic approach to this problem and an application to the in-process surface diagnosis. A near-ultraviolet - infrared high-speed spectrophotometer system has been newly developed for this purpose. The hardware system has been examined in the measurement of reflection/ emission spectrum transition of metal surfaces in a high temperature reaction process. The experimental results have demonstrated the dynamic change of radiation spectra in the wide spectral region. An algorithm of electromagnetism of interference and diffraction has been presented to analyze the strong dependence of the spectra on surface microstates. The hard- and software system can be a powerful tool for a real-time in-process technique for diagnosing the temperature and microstates of surfaces in industrial processes. Importance of the measurement of temporary/transient characteristics of materials is emphasized.