

New Facilities for the Measurements of High Temperature Thermophysical Properties at LNE

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The improvement of the energy efficiency of thermal and nuclear power plants often involves an increase of their operating temperature (up to 1500 °C for gas turbines or Generation IV nuclear reactors). These high temperatures impose the implementation of advanced materials, whose the thermal behaviour must be known in order to check their suitability for these specific applications. It is thus essential to accurately determine their thermophysical properties at temperatures close to those encountered in real situations, including for example in fission reactors under accident conditions (up to several thousands of degrees Celsius). Some thermal properties of materials are already measured at very high temperatures by research institutes which have dedicated facilities. The measurement methods used by these institutes require reference materials certified up to 2000 °C as a minimum, either for the validation of absolute measurement methods or for calibration of comparative ones. For a lot of thermophysical properties, there is currently no possibility in Europe of ensuring the traceability of these measurements to the SI above 800 °C, due to the temperature range limitation of the metrological reference facilities available in European National Metrology Institutes (NMIs) and the lack of suitable reference materials. Since 2010, LNE has worked in collaboration with other European NMIs in the improvement of the measurement capabilities of its metrological facilities in term of temperature range. This work is performed in the framework of two European projects named “MetroFission” and “Powerplant”, which are supported by the European Metrology Research Program (EMRP). This paper gives a detailed description of the metrological facilities and measurement methods which are currently under development at LNE for the measurement of the thermophysical properties of solid materials at very high temperature (up to 3000 °C for thermal diffusivity).