Spectro-Pyrometric Measurements on Solid and Liquid Uranium- and Plutonium-Carbides near their Melting Transition

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Radiance spectra of uranium- and plutonium-carbides in the visible and near-infrared have been measured using a fast multi-channel spectro-pyrometer. The samples were heated up to and beyond their melting transition using a powerful Nd:YAG laser. Based on the melting temperature of uranium monocarbide, soundly established at 2780 K, the wavelength dependence of the high-temperature near-normal spectral emissivity of some uranium carbides ($1 \leq C/U \leq 2$) has been obtained. Similarly, the peritectic temperature of plutonium monocarbide (1900 K) has been used as a reference for plutonium monocarbide and sesquicarbide. The present results on the spectral emissivities of solid uranium and plutonium carbides are close to 0.5 at 650 nm, in agreement with previous literature. The current emissivity values have also been used to convert the measured radiance spectra into temperature, and thus perform a thermal analysis of the laser-heated samples. Some high-temperature phase boundaries in the systems U-C and Pu-C are shortly discussed on the basis of the current results.