Construction and Characterisation of Eutectic Fixed Points of Cobalt Carbon (Co-C) and Palladium Carbon (Pd-C) for Non-Contact Calibration.

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Above the freezing point of Ag (961.78 °C), the International Temperature Scale of 1990 (ITS-90) is defined by extrapolating the Planck radiation from a blackbody at either the Ag, Au, or Cu fixed points. While many laboratories perform some sort of scale dissemination this way, few have the capabilities to go beyond the copper point (1084.62 °C). This is caused by the fact that high temperature eutectic fixed points like Co-C (1324.24 °C) and Pd-C (1492 °C) are non-trivial to construct, characterise and use. The motivation of using eutectic cells composed, in this case, of two materials is the ability to use them to calibrate instruments like thermocouples (contact method) and pyrometers (non-contact method) at temperatures that are beyond the limitations of platinum resistance thermometers (PRTs). In this contribution, we will present the construction process of a set eutectic cells that makes use of carbon components reinforced by carbon mesh that improves the robustness of the cells during frequent thermal cycling. The description of methods used for the optimal realization of eutectic cells will be discussed. Furthermore, the definition of key metrological parameters like phase transition repeatability and stability, as well as the phase transition temperature and emissivity determination, will be presented. The research presented has been part of the European project 22RPT03 MultiFixRad, which has received funding from the European Partnership on Metrology, co-financed from the European Union's Horizon Europe Research and Innovation Programme and by the Participating States.