

Infrared Emissivity of Noble Metals and the Anomalous Skin Effect

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We report some novel experiments results concerning the emissivity measurements of pure metals using the new Reduced Background Calibration Facility 2 (RBCF2) at PTB¹ and corroborated at UPV/EHU using an upgraded version of its HAIRL emissometer.² The optical properties of noble metals (Cu, Ag, Au) can be described using the classical free-electron optical theory with an additional term to account for the extra emission due to the anomalous skin effect.³ Good-quality emissivity data was obtained, which could be reproduced using the extended free-electron theory, with only the surface specularity parameter p as a free variable. The importance of controlling roughness and surface contamination for obtaining reproducible data for these materials was also revealed, as well as differences between bulk and film samples. Tentative differences are observed between gold (which suggests better agreement to a $p=1$ specular surface) and silver and copper (which are closer to the predicted values for $p=0$ diffuse surface). A weighted linear regression of the curves suggests that the results for gold and silver are statistically significant, whereas those of copper show a larger discrepancy.

References

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