Public Abstract
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Title:TOTAL HEMISPHERICAL EMISSIVITY OF VERY HIGH TEMPERATURE REACTOR (VHTR) CANDIDATE MATERIALS:
HASTELLOY X, HAYNES 230, AND ALLOY 617

An experimental system was constructed in accordance with the standard ASTM C835-06 to measure the total hemispherical emissivity of structural materials of interest in Very High Temperature Reactor (VHTR) systems. The system was tested with 304 stainless steel as well as oxidized and un-oxidized nickel, and good reproducibility and agreement with the literature data was found. Emissivity of each candidate material was measured over a wide range of temperatures, with conditions that included: i) 'as-received' (original sample) from the supplier; ii) increased surface roughness; iii) oxidized, and iv) graphite coated.
The emissivity of as-received materials increased with temperature for Hastelloy X (from 0.18 at 473 K to 0.28 at 1498 K), Haynes 230 (from 0.178 at 600 K to 0.235 at 1375 K), and Alloy 617 (about 0.2 at 600 K to about 0.35 at 1275 K). Oxidation was found to increase emissivity, but as there is some oxidation of these materials used in the construction of VHTRs, this represents an essentially neutral finding in terms of the safety implications in post-accident VHTR environments. However, a coating of graphite powder was shown to substantially increase emissivity, and this has strong favorable safety implications in terms of decay heat removal in post-accident VHTR environments.