

A High-Resolution Measurement of Ball IR Black Paint's Low-Temperature Emissivity

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Abstract:

High-emissivity paints are commonly used on thermal control system components. The total hemispheric emissivity values of such paints are typically high (nearly 1) at temperatures above about 100 Kelvin, but they drop off steeply at lower temperatures. A precise knowledge of this temperature-dependence is critical to designing passively-cooled components with low operating temperatures. Notable examples are the coatings on thermal radiators used to cool space-flight instruments to temperatures below 40 Kelvin. Past measurements of low-temperature paint emissivity have been challenging, often requiring large thermal chambers and typically producing data with high uncertainties below about 100 Kelvin. We describe a relatively inexpensive method of performing high-resolution emissivity measurements in a small cryostat. We present the results of such a measurement on Ball InfraRed Black™ (BIRB™), a proprietary surface coating produced by Ball Aerospace and Technologies Corp (BATC), which is used in space-flight applications. We also describe a thermal model used in the error analysis.