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Terahertz Computed Tomography of NASA Thermal Protection System Foam Materials

Source

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Abstract

A terahertz (THz) axial computed tomography system has been developed that uses time-domain measurements in order to form cross-sectional image slices and 3D volume renderings of THz-transparent materials. The system can test samples as large as 0.0283 m(3) with no safety concerns. In this study, the system was evaluated for its ability to detect and characterize drilled holes and embedded voids in foam materials that were utilized as thermal protection on the external fuel tanks of space shuttles. X-ray micro-computed tomography was also performed on the samples to compare against the THz computed tomography results and better define embedded voids. Limits of detectability are loosely defined, based on depth and size for the samples used in this study. Image sharpness and morphology characterization ability for THz computed tomography are qualitatively described.