

COMPUTER-AIDED ENGINEERING DESIGN OF HTXRD RESISTIVE HEATING STRIPS TO MINIMIZE SAMPLE TEMPERATURE GRADIENT

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Reliable high-temperature XRD measurements require a uniform temperature distribution over the entire area of the sample. Typically, HTXRD stages use a resistive heating strip, where the ends that form the electrical current contacts are maintained near ambient temperature. Because of thermal resistivity of the material, the temperature distribution along the length of a short heating strip is roughly parabolic, leading to temperature gradients along the length of the sample. In addition to conductive losses, radiative and convective losses and temperature dependent electrical resistivity also contribute to the temperature profile, making a direct analytical solution difficult.

Although the roughly parabolic temperature profile of a heated strip is an unavoidable consequence of the geometry described, there is no requirement that heating strips be uniform in their properties. This suggests that engineering the properties of a heating strip might be possible to minimize the temperature gradients along the length of the sample area.

We describe a theoretical and experimental study of a method to flatten the temperature gradient in the center of a heating strip by introducing regions of high thermal and electrical resistance at the edges of the sample region. One approach for creating regions of high resistance that we have validated is to simply drill holes in the heating strip. The effects of size, shape, location and number of holes will be described. In addition, we will describe preliminary results on composite heating strips.