Microfabrication of Metallic Magnetic Calorimeters

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Metallic magnetic calorimeters (MMCs) are energy dispersive particle detectors which have a high energy resolving power over a wide energy range as well as a quantum efficiency of up to 100%. They can nowadays be reliably produced by means of multilayer microfabrication techniques. Moreover, the consequent use of these techniques allows for the fabrication of thousands of virtually identical detectors as it is

required for the development and implementation of large detector arrays. Using different examples of state-of-the-art MMC detectors which are currently used for various kinds of application such as high-resolution x-ray spectroscopy, we present our techniques for MMC fabrication. These include the fabrication of micron wide Nb stripes with a length up to several tens of meters that have critical current density which is close to the bulk value as well as on-chip persistent current switches allowing for the preparation field generating of a persistent current in the pickup coils of the detector. The paramagnetic temperature sensors of our detectors are made either of co-sputtered Au:Er with a tunable Er concentration between 200ppm and 900ppm or sputtered Ag:Er with a fixed concentration of about 330ppm. Experimentally we have been ask to proof that these microfabricated planar temperature sensors show the thermodynamic properties as expected from bulk material. Depending on the application the particle absorbers which are typically made of Au needs to have a thickness of up to several hundred microns in order to achieve a high quantum efficiency for the incoming particles. Since such thicknesses can hardly be realized by evaporation or sputtering techniques, we have implemented an electroplating process allowing for the fabrication of thick and large area absorbers made of Au. This process particularly allows for producing free-standing absorbers with areas larger than 1 cm^2 that are supported by only a very few stems with a diameter of several microns. Finally, we discuss a process which we are currently developing that will allow for the thermalization of the detectors by means of metallic links through the entire substrate to the underlying sample holder.