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Noise Characteristics of Nanocluster-Based Chemiresistors WALTER KRUPPA, RONALD RENDELL, ARTHUR SNOW, EDWARD FOOS, MARIO ANCONA, Naval Research Laboratory — Thin films of metallic nanoclusters interspersed between interdigitated electrodes are the basis of a promising chemiresistor technology known as MIME sensors. The chemical vapor detection limit of these sensors is set by their signal-to-noise ratio at low frequencies where the noise is found to be 1/f in nature. In this work we explore the experimental dependences of the 1/f noise on various material parameters such as nanocluster core diameter, shell thickness and shell composition. Among other things, we find that the 1/f noise decreases by more than three orders of magnitude as the core diameter increases and the shell thickness decreases, observations that are expected to be important for sensor design. The data are found to fit the well-known Hooge formula and this allows the intrinsic strength of the 1/f noise to be gauged using the Hooge parameter. For the interpretation one needs to know the number of electrons participating in the transport and we discuss how this can be obtained through simulation using the orthodox theory of Coulomb blockade. This factor is then shown to be crucial for understanding the trends in our noise data.

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