Technical Assistance Request

The unique challenges with the geothermal rated wide band vibration sensor and accelerometer are the optimization of the final sensor dimensions and the optimization and characterization of the thick film pastes.

The physical dimensions of the mass support beams and the size of the mass determine the sensor bandwidth and the g-force range. The mass and beam dimensions should also recover from g-force shocks in the 500 g to 1,000 g range. The thickness of the piezoelectric thick film on the beams determines the sensor sensitivity, which should be more than an order of magnitude higher than the electrical thermal noise at 1 milli-g. Finite element simulations will be a critical step in the final sensor dimensions.

The thick film pastes for the conductive nickel, glass dielectric insulator, and the piezoelectric must be optimized for adhesion, performance, and low carbon content (residue from the sintering process). Once optimized, the pastes must be fully characterized to aid in future simulations.

Assistance is requested from both the National Labs and the American-Made Network with the initial design changes to a 3D printer, simulation and optimization of the geothermal rated vibration accelerometer sensor in a package design, and the optimization of the thick film pastes, which must have low carbon content at high temperatures to limit current leakage effects. Figure 1 depicts the as printed 3D sensor concept, which includes an integral package. Figure 2 depicts the thick film paste layers that comprise the sensor.

Figure 1

All Materials Thick Film Additive Manufactured on Ceramic Substrate

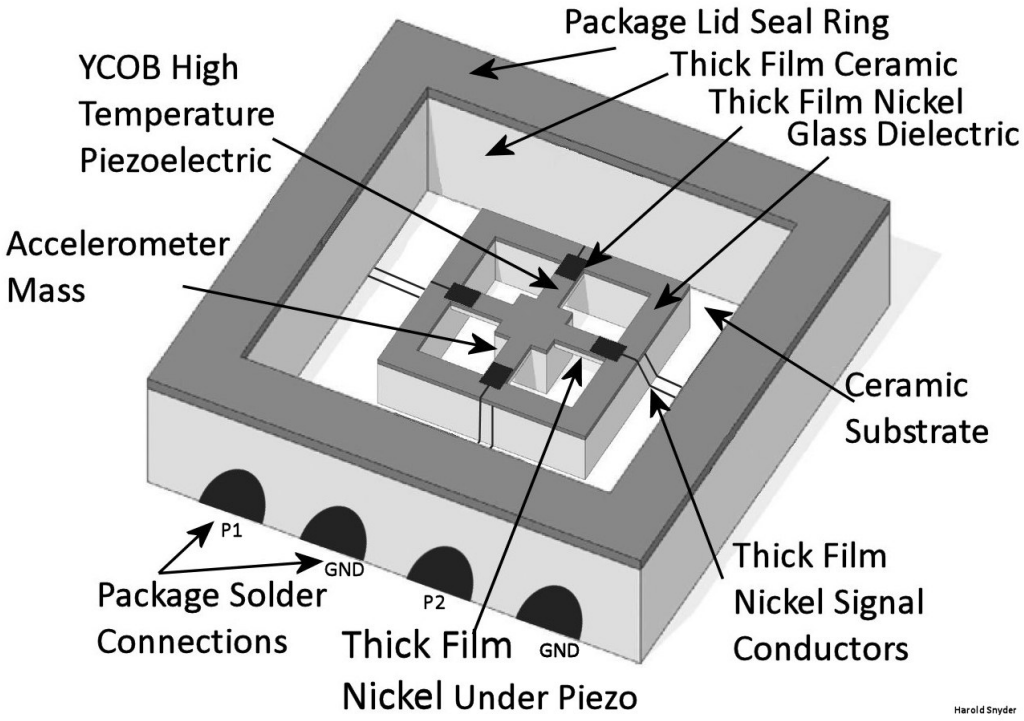
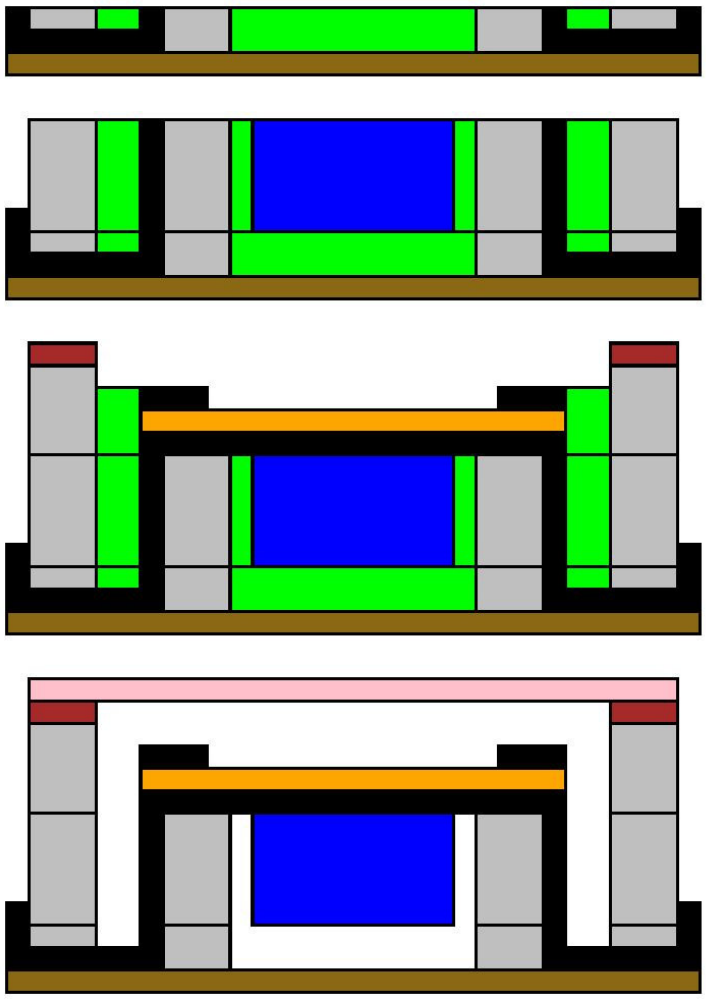


Figure 2



Sacrificial Paste
Nickel Thick Film
99% Alumina Substrate
Dielectric Thick Film
Floating Mass

Lid Seal Ring
YCOB Piezoelectric Thick Film

Firing to 850C Sinters Thick Film
Sacrificial Thick Film Paste
Vaporizes During Firing
Lid Seals Vacuum Inside

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