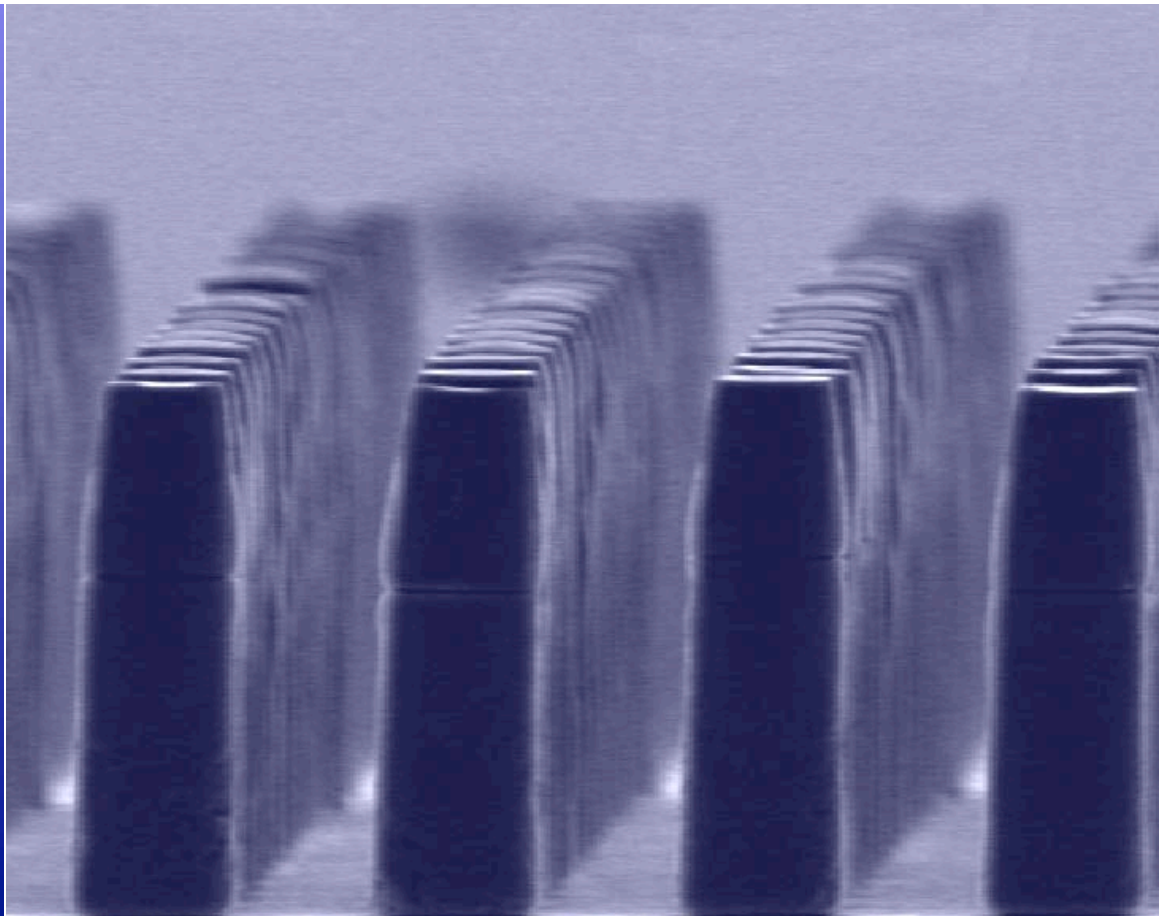
ULTRASOUND

Penn State MRSEC



Metal posts form the template of a high resolution ultrasound imaging array which can operate at a frequency a hundred times higher than that of traditional biomedical ultrasound.

Transducer arrays for biomedical imaging
living cells bathed in sound

IRG3

Ultrasound array transducers offer non-destructive real-time imaging of living tissues for both fundamental research and clinical diagnoses. Commercial ultrasound arrays operate at frequencies up to 16 MHz, which provides a resolution of 50 microns. We are developing a novel ultrasound imaging system that will improve the resolution two orders of magnitude by increasing the operating frequency up to hundreds of MHz and close-coupling the electrical circuitry onto the same chip as the transducer array.

During the past year a MRSEC research team (H.S. Kim, I. Kim, I. G. Mina, S. K. Park, K. Choi, T. N. Jackson, R. L. Tutwiler, and S. Trolier-McKinstry), has been working with Phillips Research to miniaturize the transmit and receive electronics for an ultrasound imaging system onto a single CMOS chip, an advance made possible by new transducer manufacturing techniques that allow for much lower drive voltages. The entire electronics package for image acquisition is now closely coupled to the transducer array.

With further development, this integrated high-resolution ultrasound system will enable researchers to monitor the drug reactions of individual live cells. Miniaturized ultrasound imaging arrays could be brought inside the patient's body, either on catheters or within pill cameras, for real-time tissue biopsies and subsurface imaging in turbid environments. Limited motion control (including the ability to reorient the camera) is also possible. Templates for preparation of the transducer by mold infiltration are being supplied by Philips Research, one of the major world suppliers of ultrasound equipment.