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Nanoscale Photoconductivity Imaging of Thin-film Semiconductors by Laser-assisted Microwave Impedance Microscopy[1] ZHAODONG CHU, DI WU, YUAN REN, SEUNGCHEOL YANG, LIUYANG SUN, XIAOQIN LI, KEJI LAI, University of Texas at Austin — The photo-response of semiconductors is usually studied by detecting the photocurrent across source-drain electrodes under light illumination. By integrating the microwave impedance microscopy (MIM) technique with focused-laser stimulation, we are able to perform the real-space photoconductivity mapping of photo-sensitive materials without the need of patterning contact electrodes. Here, we report the MIM results of various thin-film materials, such as In2Se3 nano-sheets and transition metal dichalcogenides (TMD) flakes, illuminated by laser beams of different wavelengths in the ambient condition. With no or below-gap illumination, the samples were highly resistive, as indicated by the low MIM signals. The MIM contrast emerges under above-gap light and increases as increasing laser intensity, which clearly demonstrates the local imaging of photoconductivity rather than the transport photocurrent. Interestingly, clear domain structures with mesoscopic length scales were seen in the data due to the coexistence of multiple phases in In2Se3. The unique combination of MIM and laser stimulation thus provides a new direction to explore the microscopic origin of various light-driven phenomena in complex systems.

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