

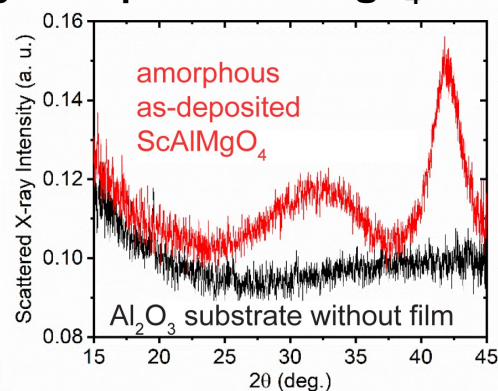
Solid-phase crystallization produces oxide buffer layers lattice-matched to semiconductors

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Engineers currently lack good substrate materials on which to grow thin films of materials like GaN with few defects. These layers are needed in applications like high-power transistors and solid-state lighting. Available bulk crystals have the wrong crystal structure or the wrong distance between the atoms.

The Wisconsin MRSEC has developed a buffer layer material and related synthesis method that promises to alleviate the substrate problem. The material is ScAlMgO_4 , which is a structurally and chemically desirable substrate, but cannot be synthesized by conventional means because of undesirable chemical reactions. MRSEC researchers have synthesized ScAlMgO_4 by solid-phase epitaxy, which involves crystallizing an initially amorphous ScAlMgO_4 layer, a state in which it lacks the sharp x-ray diffraction peaks that characterize crystalline materials. High-magnification imaging in an electron microscope shows that there is no reaction with the material the layer sits on, producing a surface suitable for subsequent growth of semiconductors like GaN.

X-ray scattering following deposition: Initially amorphous ScAlMgO_4



Electron microscopy after crystallization: Epitaxial ScAlMgO_4 without interface reaction

