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Universal method for creating optically active nanostructures on layered materials[1] TIM KIDD, RUI HE, ANDREW STOLLENWERK, AARON OSHEA, BEN BECK, KYLE SPURGEON, University of Northern Iowa, GENDA GU, Brookhaven National Laboratory — We report a new method for the creating of nanostructures using a scanning electron microscope. Residual organic molecules on the surface of layered materials can be excited by electron beam radiation to burrow into the open spaces between the layers of these materials, and then are broken down further to form photoluminescent carbon nanoclusters. Surface characterization by atomic force microscopy shows the surface is nearly undamaged at the molecular level by this process, and a lack of nanostructure formation in non-layered materials confirms that the structures are created by sub-surface incorporation. The presence of carbon nanoclusters was determined by Raman Spectroscopy and photoluminescence in the visible light range. The nanostructures are react strongly to visible light, making them readily apparent using an optical microscope even for features measuring only a few nanometers tall. This technique can be used on apparently any layered material, with successful results on dichalcogenides, topological insulators, graphite, and high temperature copper oxide superconductors. This technique can create patterned nanostructures with vertical resolution at the nanometer scale and lateral resolution of tens of nanometers depending on beam spot size.

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