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Solution Processing of Ordered Thin Film Nanowire Composites by Magnetic Field Alignment[1] JONATHAN SINGER, CANDICE PELLIGRA, SU HUANG, CHINEDUM OSUJI, Yale Department of Chemical and Environmental Engineering — Vertically aligned nanowire forests are a desirable geometry for many applications, including as electrodes, heterojunctions, and high surface energy interfaces. Most conventional aligned nanowire structures, however, are generated by methods that require (i) high temperatures, (ii) a specific substrate, or (iii) high cost lithographic techniques. We seek to utilize the magnetic alignment of cobalt-doped zinc oxide nanowires to enable the solution processing of thin films of aligned nanowires on a generalized substrate at a fraction of the cost of other methods. By functionalization of the nanowires with various surface modifications, they can be dispersed in several solvent systems and aligned by a 6 T field. Further, by including polymer in the wire solution, we can both control the areal density and also incorporate additional functionalities to the final composite device. As an example, the use of a conjugated polymer (such as poly(3-hexylthiophene-2,5-diyl) (P3HT)) allows for the final structures to act as inorganic-organic ordered heterojunction solar cells. While final device quality depends on the simultaneous optimization of several key processing parameters, the process does not rely on top-down fabrication or costly materials.

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