Light-blind UV-A detecting nanowires


UV detectors are important tools in industry in the fields of imaging, environmental monitoring, and air and water sterilization, as well as flame sensing and detection of rocket engine plumes. UV-A which has wavelengths ranging from 400 to 320 nanometers and is the region of the spectrum that penetrates the atmospheric ozone layer and is linked to premature skin aging, cataracts of the eye and skin cancers. Unfortunately, the one-dimensional nanostructures based on zinc oxide, zinc sulfide and tin oxide have numerous limitations. They are slow response materials and high dark currents impede performance.

Now, Xiaosheng Fang of the Department of Materials Science Fudan University Shanghai and colleagues Hui Liu, Zhiming Zhang, Linfeng Hu, Nan Gao, Liwen Sang, Meiyong Liao and Renzhi Ma, working with Fangfang Xu of Chinese Academy of Sciences, also in Shanghai, China, have developed a facile synthetic method for generating nanowires with diameters of 100 nanometers and lengths of several tens of micrometers from niobium(V) oxide and molten potassium chloride in a conventional horizontal furnace. Their work inspired by the known interesting properties of alkaline metal niobates that show non-linear optical responses, have ionic conductivity, ferroelectricity, piezoelectricity and photocatalytic activity. The team characterized their nanowires using field-emission scanning electron microscopy and transmission electron microscopy equipped with an X-ray energy dispersive spectrometer.

Specifically, the team was well aware of the good dielectric properties and photocatalytic activity of potassium niobate. The material’s 3 electronvolt band gap (equivalent to 400 nanometers in its UV-Vis spectrum also bode well for its potential as a UV-A detecting materials. Previous researchers had used the material to produce sodium and calcium niobate nanorods through an ion-exchange approach. However, the Chinese team reasoned that synthesizing potassium niobate nanowires using a molten method would allow them to create a more consistent product. The researchers’ tests on UV-A detectors made with the potassium niobate nanowires reveals them to have high sensitivity and spectral selectivity and to suggest that the wires are intrinsically blind to visible light.

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