Piezoelectrics: Putting the "Squeeze" on New Materials

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Due to the environmental impact of lead, there is a considerable focus on the synthesis of lead-free piezoelectric materials. $Pb(Zr,Ti)O_3$ (PZT) is the current industry standard for piezoelectric ceramics, has a major disadvantage in that it contains lead which is increasingly regulated. To date, very few lead-free materials come close to the same high performance that is observed in PZT. A-site bismuth perovskites appear to be the most viable alternative, as Bi^{3+} ions will also have lone-pair distortions similar in magnitude to their lead-based counterparts. Although replacing lead with bismuth may seem straightforward, it adds a layer of complexity as few A-site bismuth perovskites are stable under ambient pressure (due to the small size of the Bi^{3+} ion, which can cause instability in the AO_{12} polyhedra) with $BiFeO_3$, $Bi_2(Mn_{4/3}Ni_{2/3})O_6$, and $Bi(Fe_{2/8}Mg_{3/8}Ti_{3/8})O_3$ as the only examples.[1-3] This talk will be broad in scope, discussing the background behind piezoelectrics and our group's attempts to synthesize and characterize new high performing, lead-free piezoelectric materials

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