Thermionic converters can be fabricated using extensions of MEMS technology, in which advances in materials, micromachining, and vacuum encapsulation processes can be used to enhance performance and reduce manufacturing costs. Potential commercial applications include small-scale co-generation. Recently, a new conversion concept has been demonstrated at Stanford, in which a semiconductor photocathode replaces the conventional metal cathode. This photon-enhanced thermionic energy (PETE) converter harvests photon energies above the bandgap, as well as broad-spectrum radiation through heating of the photocathode, making it attractive as a high-temperature topping cycle for solar-thermal power stations. Micro- and nano-structured, high-temperature materials and micromachining processes are also essential to fabricating wafer-scale, cost-effective PETE converters. I will conclude by summarizing the research directions that are needed to bring thermionic and PETE converters into the mix of energy conversion technologies.

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