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Electronic eyes enabled by stretchable electronics: mechanics, materials, and optics

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ABSTRACT

Stretchable electronics combines the electronic performance of conventional wafer-based semiconductor devices and mechanical properties of a rubber band, and thus can have very broad applications that are impossible for hard, planar integrated circuits that exist today. Examples range from surgical and diagnostic implements that integrate with the human body to provide advanced therapeutic capabilities, to structural health monitors and inspection systems for civil engineering. In this discussion, I will discuss our development of electronic eye-ball cameras enabled by stretchable electronics and mechanics. Electronic eye-ball cameras have high performance photodetectors distributed on curvilinear surfaces and offer advantages over comparable systems that use conventional, flat detector arrays. Our recently developed artificial compound eye with designs inspired by arthropod eyes will also be introduced. This artificial compound eye can achieve wide-angle field of view, low aberrations, high acuity to motion and an infinite depth of field, which were not possible through conventional technology. Mechanics, materials, and optics of these systems will be discussed.