

A Hydrogel Adhesive Marine Sensing System: Design, Mechanism, and Applications

by

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Abstract

Marine animals offer a wealth of knowledge that goes beyond their role as a protein source for humans. They offer valuable insights into the health of our oceans and provide inspiration for the design and control of unmanned underwater vehicles. Research into their migrational patterns and response to external stimuli such as sonar, drilling, and offshore energy production is also important for informing government agencies and engineers of the potential effects of such activities on local fauna.

Traditionally, sensors used to gather data from marine animals have been invasive and cumbersome, involving the use of anchors, bolts, or sutures. In this study, a hydrogel adhesive marine tagging system has been developed that offers rapid (less than 20 seconds), robust (interfacial toughness $> 160 \text{ J m}^{-2}$), conformable, and non-invasive integration on a variety of marine animals. This system is tested on live marine animals to evaluate its effectiveness against current methods, and it has the potential to revolutionize the field by providing a reliable, quick, and non-invasive method of adhesion.

In this study, hydrogel mechanics and design strategies are also presented, providing a deeper understanding of the adhesive system. The effectiveness of the system is demonstrated by deploying it on a skate to collect data that can inform the design and control of underwater robots. Overall, this hydrogel adhesive marine tagging system represents an exciting development in the field of marine technology and has the potential to provide valuable data while minimizing harm to marine animals.

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