Description of NOVA's "Making Stuff: Smarter"

This episode looks into the growing number of materials that can shape themselves—reacting, changing, and even learning. For inspiration and ideas, scientists are turning to nature and biology and producing innovative developments in materials science. The sticky feet of geckos have yielded an adhesive-less tape. David Pogue literally swims with the sharks to understand bacteria-resistant sharkskin, which is being used to develop an antibacterial film. He also visits a scientist who has created a material that can render objects invisible.

Main Ideas

- Smart materials can change properties, respond to their environment, and offer more functionality than conventional materials. Nature and biological systems provide inspiration for the development of smarter materials.

- Materials scientists can manipulate the surface of a material on a very small scale to change its properties. For example, the surface of an antibacterial film is made up of a repeating pattern of tiny channels and pillars that inhibits the growth of bacteria. A smart adhesive can be controlled to be sticky only under certain conditions by changing the amount of surface contact; this is similar to how geckos adhere to a surface using the intermolecular forces from millions of tiny hairs.

- Materials scientists are developing materials that can heal themselves, much like the human body heals a cut. For example, scientists have created a self-healing coating that protects the fuel tanks of military vehicles. If a bullet punctures the tank, the coating swells to seal the hole, preventing fuel leakage.

- A smart fluid can change its properties. A magneto-rheological fluid is a smart fluid that increases its viscosity in response to a magnetic field. Smart fluids could be used to absorb unwanted movement, such as that caused by earthquakes, wind, or driving on a bumpy road.

- Materials can be designed to change shape in response to their environment, such as piezoelectric ceramics (which change shape in response to electric charge) or shape-memory alloys (which return to their original shape when exposed to a certain environment, such as heat).

- Current medical applications for smart materials include stents made from shape-memory alloys and plastic implants that release drugs at a set rate. In the future, smart materials may be able to deliver drugs directly to targeted cells in the body.

- Metamaterials can manipulate light. Materials scientists are developing materials that can create cloaks of invisibility and have the potential to make amazing new lenses.