Effect of Conductive Inks in Silicone Based Wearable Technology on the Human Body

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Point of care technology, which monitors the human body through direct-contact sensors, has been on the rise. The next step would be to sense problems and then release medicine or nano-technology into the body. However, it has not yet been determined whether the sensor itself will adversely affect the human body through leaching of electronic material or suffocating the skin. My work quantifies the effect that sweat has on these sensors by monitoring resistance change, weight change, and durability during stretching. By using common conductive metals implemented in electronics today, estimations of reactions in sweat-like buffer become possible. Prototype resistors of silver conductive ink and carbon black powder with a silicone casing were used to model wearable sensors under flexibility conditions similar to those of human skin. When measuring changes of prototypes two groups were tested, one at physiological and another at room temperature. A resistance change study was done to discern what types of conductive materials, powdered or ink, were more effective in minimizing resistance change and leakage. At physiological temperature, the carbon had a percent resistance change of -20. Three types of silver resistors were made to reduce fracturing and disconnections: a carbon ink layer with a silver layer on top, a carbon and silver flake mix, and a carbon-silver-carbon. The carbon-silver changed by -36.781% making it the most effective in preventing resistance change. Since the leakage of the resistors can be directly related to their resistance change it’s clear that a powdered conductive material is more effective in preventing leakage and change. If however, a conductive ink is to be used, it is most effective to include a powder+silicone mix as a stabilizer.