Sweatshirt: Fabric Biofuel Cells for Energy Harvesting from Perspiration

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The wearable technologies sector, despite advancements, has had little market penetration due to bulky electronic power systems which are harder to wear comfortably and wash. This project examined the possibility of harvesting electrical energy from perspiration in a light-weight power source for low-voltage electronics in athletic garments, tapping into this natural bio-electrochemical system through a durable fabric cell. The research work determined several factors affecting sweat properties and power generation. The next phase developed cells with various fiber blends, electrodes and cell designs to measure power generation and meet the objectives considered in the development of the presented product: being non-invasive, light weight, flexible and favorable to production into wearable athletic garments available on the market. The “final” product, developed in a serial circuit layout, diodes and boost converter with a supercapacitor and transistor, was created using screen printed surface electrodes (carbon & silver) on a fabric base. Using a blend of hydrophilic and hydrophobic fibers to move molecules to the surface in a capillary action, the cell then disperses the sweat molecules horizontally to increase evaporation rate. This system increases contact between surface ions and electrodes to heighten generated voltage in a portable small scale semi-capacitive-deionization. The project, to be integrated into manufactured compression garments, absorbs external heat through capillary action and decreases internal temperatures with intensity based on that of the work out. Additionally, the cells provide a light-weight power source to recharge athletic monitors in a closed circuit to replace the rigid systems hurting this industry today.