There is substantial and growing interest in the development of flexible electronic (FE) circuits. FE circuits allow conformability of circuits for greater functionality and lower production costs. Many existing industries and electronic devices would benefit from this technology. As examples, FEs can be used: in garments or on the body as a sensor; in the automotive industry, for directly mounting IDs to inside of door frames; in alternative labeling for flexible packaging, providing extensive information compared to presently printed packaging; and even for FE super-capacitors, which can be rolled to form multi-stacked devices.

FEs are created by printing some (hybrid FEs) or all of the circuits. Printing is a cost effective manufacturing method because, unlike subtractive methods, printing circuits do not require high-vacuum and high-temperature deposition processes or photolithographic patterning.

Some FE applications require circuits to be attached directly onto a flexible/foldable (i.e., skin or cloth) or an odd-shaped surface, rather than being printed on a semi-flexible support, with the circuit and support being incorporated into or on the application. Present methods of printing FEs on semi-flexible substrates are not fully applicable to this new class of flexible integrated electronic devices, circuits and systems.

**Technology Description**

Dr. Atashbar’s laboratory has created self-supporting FE circuits. Unlike other FEs, the self-supporting FEs are not printed directly on a substrate, like PET. The FEs circuits are printed on a sacrificial layer attached to the substrate. The sacrificial layer is dissolved, releasing the circuits from the substrate. As an alternative, the circuit and sacrificial layer are removed from the substrate and the sacrificial layer is dissolved after positioning the circuit on a surface (i.e. skin) to create a tight connection between the surface and the circuit. This creates thinner, very flexible, and self-supporting electronic circuits.

The substrate can pose compatibility issues in FE’s production and use. Also, because the substrate can be less temperature resistant than the circuit, the self-supporting FEs can be processed or used at higher temperatures after removal from the substrate or they can be moved onto a temperature resistant substrate.

Examples of self-supporting FEs that have been created are: sensors, capacitors, inductive coils, thin film transistors, resistors, diodes, and organic light emitting diodes.

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shapes providing for a large number of useful applications not possible with brittle conventional silicon based electronic devices or even substrate supported Fes.

**Potential Benefits**

- Flexible, conformable, thinner and lighter weight products
- Wearable products that bond with skin
- Greater temperature range for production and use
- No substrate compatibility issues