Using transparent silicone glue and conductive threads to make flexible LEDs Circuit

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This experiment is part of my Mphil/ Phd Reseach which entitled 'Embedding Light and Sound in Textiles for Novel Effects in Interior Design'

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Materials:

Silicone Glues:

"Silicones are largely inert, man-made compounds with a wide variety of forms and uses. Typically heat-resistant, nonstick, and rubberlike, they are commonly used in cookware, medical applications, sealants, adhesives, lubricants, and insulation."

There are many types of Silicone Glues that can easily be purchased on the local market.
These are available in different colours such as black, white and red. Red silicone is normally used for extremely hot temperature for example, inside of cars' engines).

Silicone has the following properties:

- Waterproof
- Resistance to oxygen, ozone and sunlight
- Excellent electrical insulator
- Shockproof
- Non-stick
- Low Toxicity
- Low chemical reaction

Dries out fairly quickly

Conductive Threads:

Conductive threads were purchased from the Internet from Lame Lifesaver (http://www.members.shaw.ca/ubik/thread/order.html). They come in 200-yard spool at $20.00 (Canadian dollar) per spool plus shipping cost. This thread is sufficiently conductive and stronger as compared to domestic poly/cotton thread and behaves like conventional cotton and is made of over 100 stands each with nano-coating of silver. It has an electrical resistance of just 4 Ohms per 100 mm. It can be applied by hand or machine and is available in limited number of colours.

The advantages of using conductive thread were:

- It could bent several times without breaking
- It was more flexible
- It did not require any soldering since it could be tied with knots.
- In order to have a better conductivity, several ends of the conductive thread could be twisted together.

Methodology:

Making the circuit:

The circuit consists of 3 flat square LEDs, connected to the Conductive Thread. The anode and cathode of the LEDs were cut and bent as shown in Plate 1 below. Three ends of the conductive thread were twisted together so as to improve the conductivity. The Anode and Cathode of the LEDs were bent over the conductive thread, Plate 2.

Plate 1: Twisted Conductive Threads and Modified LEDs

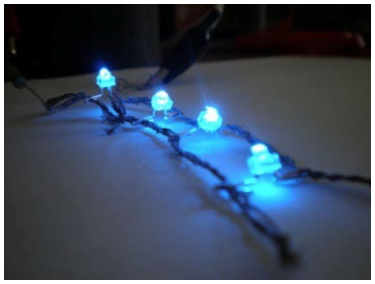

Plate 2: Testing the Circuit

Plate 3: The Complete Circuit

A rectangular piece of Aluminium, of size 8 cm by 5 cm with 3mm thickness, was used as a mould, Plate 4.

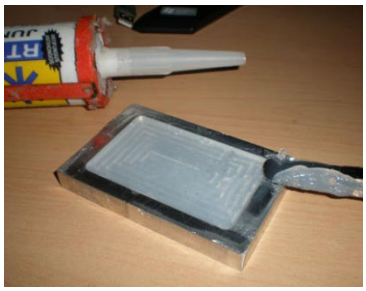

Plate 4: Applying silicone glue in the mould

The thin layer of the silicone was spread inside the mould and levelled with a palette knife. The electrical circuit was then inserted into the wet silicone and then left to dry. Once dried, the silicone was easily removed from the mould. The silicone is very adhesive and normally will glue to most materials. The surface of the aluminium mould was made very smooth and this prevented the silicone to adhere to the surface.

Results:

When hardened, the silicone became an insulator which prevented the circuit from getting wet, absorbing shocks and allowing the circuit inside to bend in any directions without compromising the connections.

The silicone circuit was further connected to a power supply and illuminated instantly creating a nice strong glow, Plate 5. It was interesting to note that the silicone could be bent to almost 360 degrees on either side. While bending the silicone circuit, the LEDs inside, continued to stay lit, Plate 6.

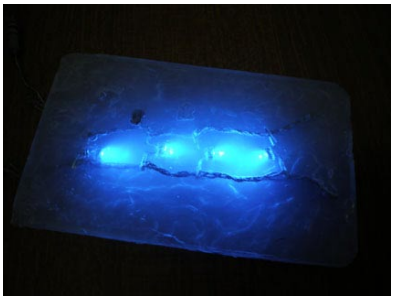

Plate 5: Illuminated E-label

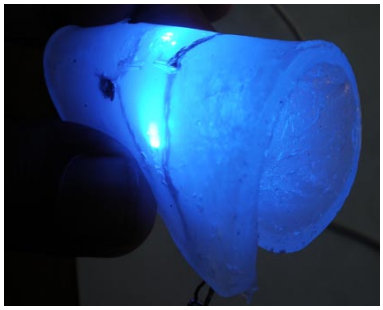

Plate 6: Bending the E-label

The silicone circuit was hand-washed several times. After each washing and drying, it was tested by connecting to the power supply. Amazingly, the circuit lit up. The circuit was casted in the silicone and therefore was well protected from water. The sample was further washed two more times and the results were all the same. All LEDs lit up opening a wider scope for more experiments.