

Feature

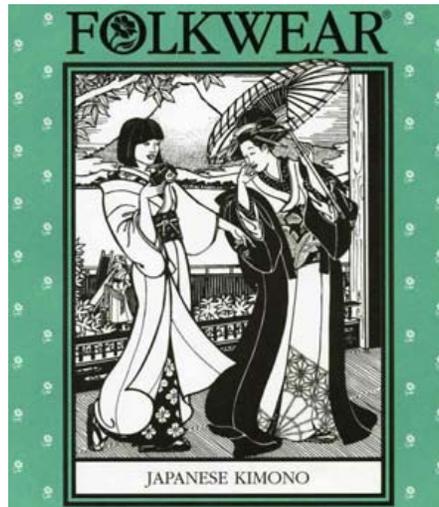


Kimono Dragon Becky Maung* and Mike Maung*

A beautiful kimono revealed a glowing Japanese dragon in a surprising presentation at Costume-Con 30 that received kudos from judges, and a Silicon Web Costumers' Guild "Dreamcatcher" award for innovative use of technology.

For both of us, the most influential mix of creative clothing, technology and art has been Burning Man. The temporary city comes alive at night with light. As a participant, illuminating yourself to be seen in the dark is important. Displaying the illumination as art is a way of contributing to the event and being seen in the dark.

It was at Burning Man where we learned about electroluminescent wire (EL wire), also known as glowwire or light wire. EL wire is used at Burning Man on signs, bikes and clothing. It introduced us to a whole new element to clothing: a way of mixing clothing and art with light, of bringing technology to clothing and giving it a glow. EL wire has a way of adding a

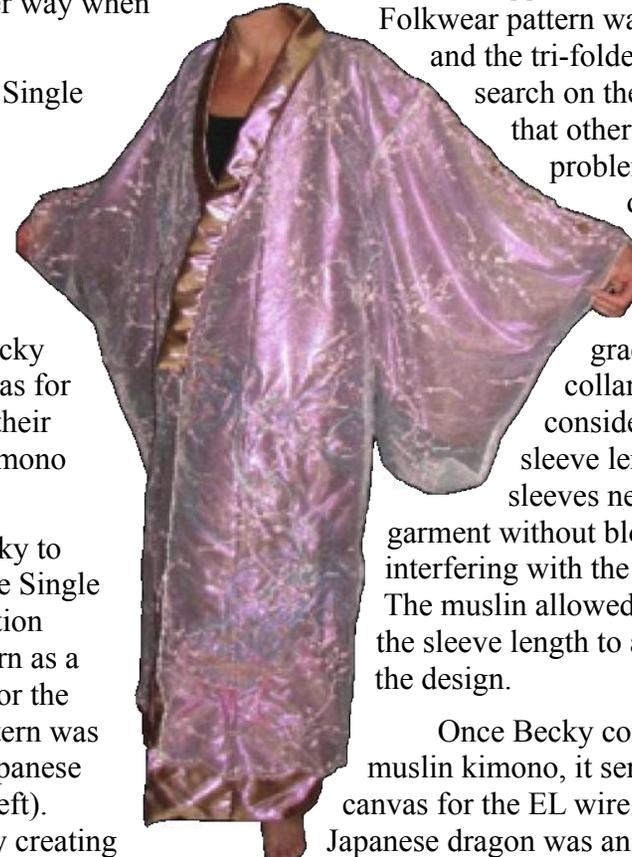


WOW factor to clothing that everyone looks for when displaying their creations. It can change the way an outfit or costume looks - one way in the light and another way when lit up in the dark.

When Becky saw that the Single Pattern wearable arts contest at Costume-Con 30 included a Japanese kimono pattern, we both knew this was the perfect chance to express the art of light, which she had been practicing for several years. Becky saw the kimono as a large canvas for an EL wire design, which was their inspiration for creating the "Kimono Dragon."

The first step was for Becky to learn how to sew a kimono. The Single Pattern competition specifies a pattern as a starting point. For the kimono, the pattern was the Folkwear Japanese Kimono #113 (left). Becky started by creating a simple muslin mock-up. This was crucial for two reasons. First, she had never sewn a kimono before, so learning to do it in muslin was much less expensive than using fashion fabric. Second,

it enabled her to envision how the EL design would fit on to the kimono.



One of her biggest challenges with the Folkwear pattern was the overband and the tri-folded collar. A quick search on the web showed that others had the same problem. She finally decided to eliminate the overband, and instead to gracefully force the collar to fit. Another consideration was the sleeve length. The sleeves needed to fit the garment without blocking or interfering with the EL wire design. The muslin allowed her to adjust the sleeve length to accommodate the design.

Once Becky completed the muslin kimono, it served as the canvas for the EL wire design. A Japanese dragon was an obvious choice that would fit the kimono's size and shape. The Folkwear pattern came with a great introduction to kimono lore. Additional research on Japanese dragons revealed that

Finished kimono with sheer cherry tree blossom fabric over reflective under-fabric for EL wire dragon

the blue dragon is a symbol of spring and young parents. Cherry blossoms came to mind as another symbol of youth and spring. Becky decided to incorporate all of these elements by putting the EL wire between a sheer fabric of cherry tree blossoms and a reflective fabric to accentuate the kimono shape and give the dragon the glow it deserved.

After some searching and a few trips to New York, we found the right fabrics to reflect the EL wire on the background and project the cherry blossoms on the outside. In the end there are three layers of fabric for the kimono – the cherry blossom overlay, the reflective fabric that the EL wire is sewn to, and a lining to protect the EL wire

connections from the person wearing it. With these design elements complete, it was time to draw the dragon.

Mike created the dragon and scaled it to fit the kimono surface. The drawing was simplified to a basic line drawing to accommodate the EL wire. Once the line drawing was complete, the colors



for the dragon's features – claws, spine, eyes and whiskers – were chosen. This final design was transferred to tracing paper in the chosen colors.

Mike also measured each color to determine the length of each EL wire, including allowance for soldering connections. Becky then pinned the tracing paper to the kimono, and hand-

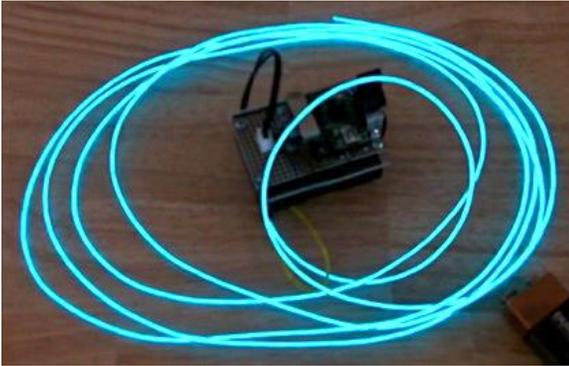
sewed the EL wire through the tracing paper and fabric by following the lines of the dragon drawing. Then she removed the tissue paper after all of the EL wire was attached.

Finally, Mike finished the dragon by soldering of the EL wire that Becky had sewn in to the costume.

Technical Considerations

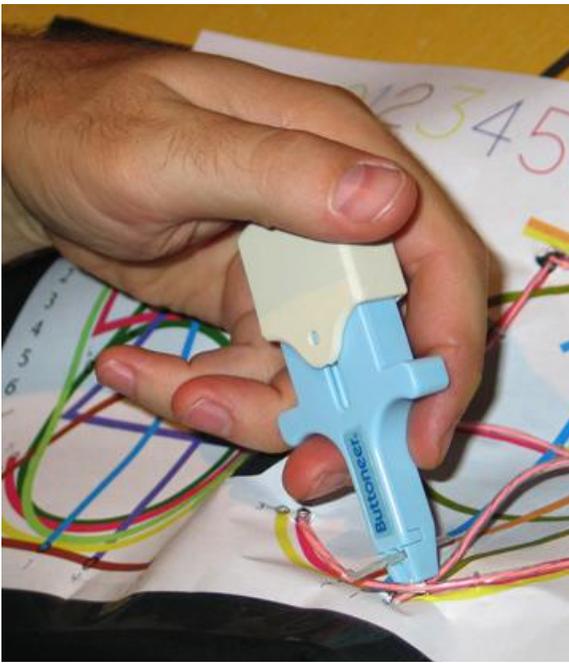
The dragon design required about 90 feet of EL wire in four colors, together with two *drivers*. A driver is a simple circuit board that provides power to the EL wire using an alternating current of electricity from a power source such as batteries. You can buy drivers pre-packaged in small boxes that include a battery connector and switch.





Driver circuit powering EL wire with 9v battery.

Most drivers can handle several runs of EL wire, and can create multiple patterns in the runs it controls by varying the current. Mike used 12 volt batteries because they wanted the EL wire to be as bright as possible. The driver will also run on 9 volts, but the EL wire will be dimmer and have a



Example of Buttoneer used to attach thicker EL wire.

shorter illumination time. Two drivers were needed to control all the runs of EL wire.

Some things to consider when using EL wire in a costume or on fabric include the total length of EL wire in the design, the fabric density and texture, and the method of attaching the EL wire to the fabric.

EL wire length. The length of the EL wire in the design will dictate what drivers and batteries will be used to power it. You will need a place to put the batteries and drivers whether it is a pocket in the garment, a hook on the inside of the garment or on the person wearing the costume. You will also need to know how to get the ends of the EL wire to the drivers – through seams or reinforced holes.

Fabric density and texture. Density and texture of the fabric are important considerations, depending on how much EL wire you are using in your design, the consecutive lines of the design, and how the light of the EL wire reacts to the fabric. EL wire can pull down if sewn to stretchy or delicate fabric, or lose its shape if sewn to a delicate fabric that can't support the bends and twists in the EL wire design. When your EL wire design line is non-consecutive you may need to poke holes in the fabric to start the color in another area of the garment. EL wire is brighter on a shinier fabric compared to one that absorbs the light; it is also a great way to create a glow under a fabric.

Method of attachment. How the EL wire is attached to the fabric depends on the thickness of the fabric, the thickness of the

EL wire, and the use of the item. A Buttoneer (bottom left) can be used for thicker EL wire (2.6 mm+) on thicker fabrics like canvas that don't require a lot of movement such as a banner. The plastic Buttoneer fastener has a tendency to fall out because thicker fabrics doesn't contract back around the fastener. Gluing the fastener to the fabric with clear Liquid Nails on the backside of the fabric can seal the hole and keeps the fastener in place. This also makes the fabric stiff. Most EL wire can be hand



Sheer fabric of cherry tree blossoms over reflective underdress with illuminated EL wire dragon.



Shrink wrap tubing seals joint by heat from hair dryer.

stitched to the garment using a 1/2" to 1" spaced blanket stitch and clear thread.

If you are using more than one color of EL wire in a design, as we did, you will need to solder the ends together on the backside of the costume. The fabric you choose should be able to withstand some mild heat from a hair dryer or heat gun to use shrink wrap tubing (above) in the connections. If your EL wire design line is interrupted with a blank space, "hide" the EL wire on the backside of the fabric by poking it through the fabric, applying shrink wrap to prevent the EL wire from glowing through and then poking the EL wire back up to the right side of the fabric to continue the run. This minimizes the connections, and the fewer the connections, the fewer the solders and the fewer the points of failure.

EL Wire Basics

Using EL wire may sound daunting, but with just a little knowledge and some practice, we think that most costumers can learn to use it, as we did.

The easiest, fastest way to start adding EL wire to your garment is to buy a kit that includes 5 feet of EL wire and a driver already soldered together, and add it to your favorite coat or garment trim – around a cuff or collar, or outline part of the fabric design. If the fabric is thick enough you won't even need shrink wrap on the backside of the fabric to hide the glow from the underside. Experiment with fabrics to see how it takes holes or reacts to the EL wire.

Here are a few basic to get you started.

- EL wire is a bendable, glowing phosphor wire covered in PVC – in whole it is a wire core with a phosphor coating wrapped with 2 hair wires all surrounded by a colored PVC coating that gives it its color. Some brands of thicker wire have PVC coating in the center wire as well as the outer surface as shown in the

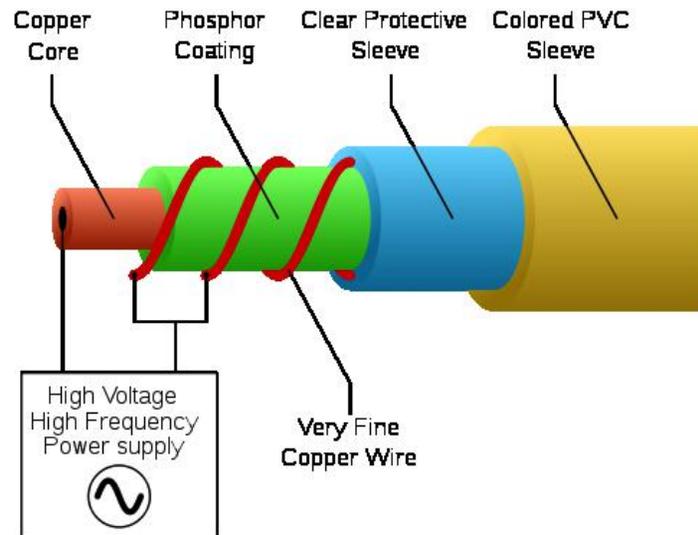
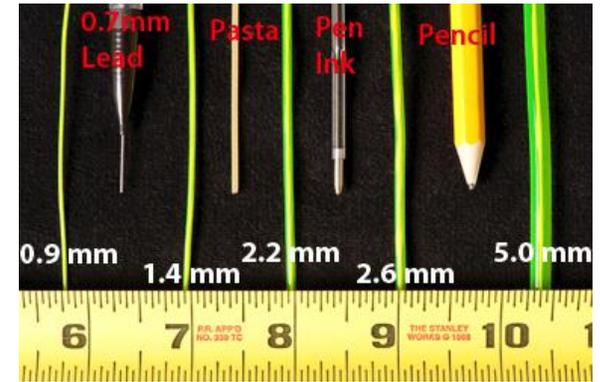


Diagram of EL wire from the [Wikipedia article](#).



Varying thicknesses of EL wire, from 0.9mm to 5mm.

Instructables.com video, "[Knowing Your Wires](#)."

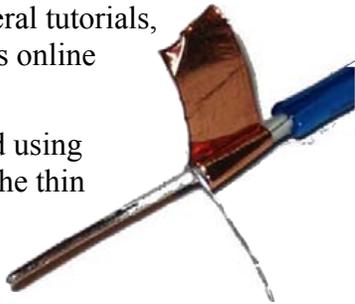
- EL wire comes in varying thickness, brightness and flexibility. The thinner the EL wire the more flexible it is. EL wire is delicate and sharp angles should be avoided to prevent the hair wires from breaking. Instead of angles use gentle folds or curves in the design.
- The EL wire is powered using a driver and batteries. The total length of EL wire will determine the size of the driver used. The longer the length of EL wire the larger the driver and the amount of voltage (number of batteries) required to light the EL wire.
- When you power on an EL wire driver it will hum.
- EL wire is generally not waterproof and should not be washed.

If you are not using a kit, soldering the EL wire is the most challenging part. The hair wires between the PVC coating and

phosphor core are very delicate and small, and it is important to be careful with them while sewing your design and in the soldering process. The hair wires can break if the EL wire bends too much or is bent back and forth – the same way a twist tie can break.

First it is important to be comfortable with soldering in general. We recommend practicing solder connections before directly applying your solder skills to an EL wire project. There are several tutorials, videos and instructions online for soldering EL wire.

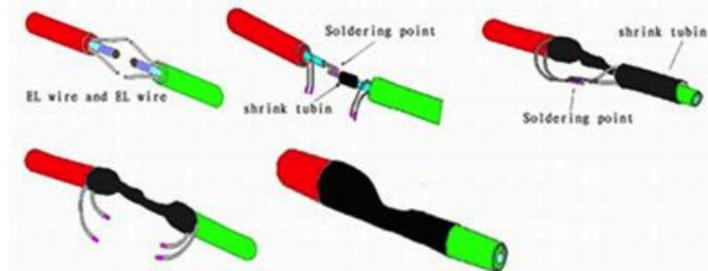
Most recommend using copper tape to solder the thin hair wires down. The copper tape can be hard to work with and slip out of the way. A good way to begin is to use shrink wrap instead of the copper tape.



To connect EL wire to EL wire:

1. You will need 3 pieces of shrink wrap in 2 sizes. Put a small piece (~1") of thin shrink wrap on each end of the EL wires – it will need to be a bit thicker than the EL wire to hold the hair wires and core wires in place - and one longer piece (~2") larger in diameter on one side – to cover the finished connection.
2. Strip 1/2" off the outside PVC coatings of each end using wire strippers. Be careful not to break the hair wires under the PVC coating.

3. Separate the hair wires from the phosphor core.
4. Gently scratch off the phosphor coating from the inner core from the tip back 1/4" toward the PVC using a razor or X-acto knife. There should be a 1/4" of phosphor between the exposed end and the PVC.
5. Take the 2 hair wires from each end of EL wire and wrap all 4 together and solder. Bend them back to the PVC on one of the EL wires, slide the small piece of shrink wrap up over the soldered hairs just past the edge of the PVC.
6. Heat the shrink wrap to tighten. You can use a heat gun, hair dryer or the solder iron to get a tight fit.
7. Twist the two phosphor cores ends together, solder and bend back to the opposite side of the hair wires, slide the small piece of shrink wrap up over the soldered cores just past the edge of the phosphor.
8. Heat the shrink wrap to tighten.
9. Take the larger piece of shrink wrap and cover the entire joint.



Connecting EL wire to EL wire. Diagram courtesy of AllExpress.com.



Soldering EL wire to driver and power supply. Photo courtesy CoolNeon.com.

10. Heat the shrink wrap to tighten.

The connector wires from the driver and power supply come with two different length wires on one end. The shorter length will connect to the center core, the longer length will connect to the hairs.

1. Put a small piece (~1") of thin shrink wrap on the EL wire – it will be used to hold the hair wires in place - and one longer piece (~2") larger in diameter on the EL wire – to cover the finished connection. Save another small piece for the connector.
2. Strip 1/2" off the outside PVC coating using wire strippers. Be careful not to break the hair wires under the PVC coating.
3. Separate the hair wires from the phosphor core.
4. Gently scratch off the phosphor coating from the inner core from the tip back 1/4" toward the PVC using a razor or X-acto knife. There should be a 1/4" of phosphor between the exposed end and the PVC.

5. Take the 2 hair wires and the longer end of the connector wire and solder to the EL wire side. Slide the small piece of shrink wrap up over the soldered ends just past the edge of the PVC.
6. Heat the shrink wrap evenly to tighten.
7. Separate the connector wire 2" more by gently pulling it apart. Trim the shorter connector end ½" more. Add a small piece of thin shrink wrap to this end.
8. Twist the core wire to the short end of the connector/driver wire and solder. Slide the small piece of shrink wrap up over the soldered ends covering all of the exposed wires.
9. Heat the shrink wrap to tighten.
10. Take the larger piece of shrink wrap and cover the entire joint.
11. Heat the shrink wrap to tighten.

To test your design, turn on the driver and make sure everything lights up. Be sure to attach the EL wire to the driver while the driver is off. You can burn out the driver if it is on when you connect or disconnect it to the EL wire. EL wire should never be put in a washing machine. If you need to clean the garment hand wash it where necessary. Or create your EL wire design on a panel that attaches to your garment with snaps or Velcro so you can remove it and the garment can be washed according to the fabric's recommended method.

Dragon Kimono Costume-Con 30 Single Pattern contest photos by [Richard Man](http://rfman.com).

Final Thoughts

Becky wore a solid silver mask and a long white wig as she came on stage during judging and showed off the kimono. Then, the lights went down revealing the glowing dragon with its many colors. The audience reaction made it all worthwhile.

We were so thrilled when the judges awarded us Best in Show, and especially pleased that the Silicon Web Costumers' Guild presented us with their [Dreamcatcher](#) award for innovative use of technologies. Kimono Dragon must be a lucky dragon!



Becky Maung has a background in information technology. In the past few years she began to introduce technology into her clothing designs by incorporating EL wire. She designed custom creations for individuals and displayed at several conventions around the country.

Mike Maung studied Fine Arts at Mass College of Art and Design. He continues to paint in oils. He has painted murals in Boston and Los Angeles and has built large sculptures at Burning Man and other regional events.

