Tips & tricks for neon signs, with a focus on crackle tubes - courtesy Marc Levy, Neonic Signs

Q How do you get the array of colours available today?

A Clear glass allows you to see the characteristic colors emitted by the original neon or argon/mercury gases. Fluorescent powders can be painted/baked to the inside of the glass tubing, converting the source light into a multitude of shades like pink, turquoise or green. By altering the mixture of elements, subtle differences are possible, e.g. from warm to cool white (colour temperatures). Tubing can also be produced in colored glass, with deep clear reds, blues or greens producing the richly saturated colours known as exotic/Euro glass. Colored glass may also have a fluorescent coating that can change both the quality/color of the light.

Q What do you need to bend glass?

A The glass is rotated and rocked (rocked and rolled) in (generally four) burner flames with a gas/air mixture to raise flame temperature. Crossfire and fishtail burners produce most angled bends and splices. Ribbon burners produce curves or sweeps. Hand torches are usually used for splices or tapering and tipping off electrodes.

Q Let's get real scientific... how does a neon tube produce light?

A Electrical current bombard the inert gas atoms with electrons - actually knocking neon's atoms out of their orbits! The electrons collide with other free electrons, sending them back toward the atoms. As the electrons are absorbed into the atom, energy is given off as light, and that's it.

Q How long does neon last?

A Neon can last decades, but in practical terms, the expected life span is between 8 and 15 years. Neon can, however, be repaired and recharged.

Q Do you use a pattern or do you bend the glass freehand?

A For most applications (signs & designs), neon is bent over a fire-resistant pattern. Artistically expressive work is often done freehand, by more experienced glass-blowers. Three-dimensional work from engineer drawings or a dimensional template is very challenging, but can be done.

Q Can neon be used with three dimensional shapes - such as a globe?

A Yes. Very interesting effects can be achieved, because the light tends to fill the object with varied coloration and, depending on the power supply, it can respond to touch. This is, however, a very advanced technique.

Q How do they make neon appear to move?

A The huge animated neon signs or "spectaculars" of the 1940s have multiple layers of neon - each powered in a timed sequence to produce the desired effect. Many other forms of movement have been found in the neon tube itself. "Wiggle tubes", "crackle tubes", "jelly beans", and "whirly gigs" are but a few examples.

Q What is a crackle tube?

A It creates a dazzling lightning-like effect in neon. The tube is usually neon-filled and gives the effect of thin, bright lightning constantly changing paths through the tube. The effect is caused by filling a glass tube with a variety of media (usually glass) - balls, tubing pieces, rings, glass aquarium sand, etc. that creates channels through which the gas discharge must pass.

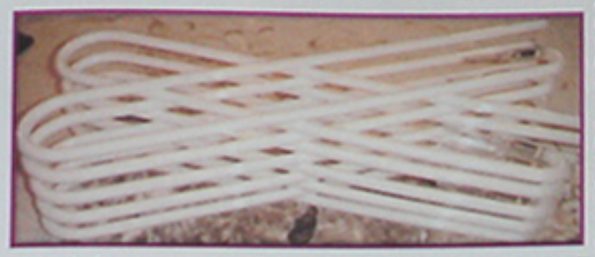
Q How do you make crackle tubes?

A Crackle tubes look better when made from large-diameter tube (20-25mm). Above 25mm, the lightning effect can get lost in the

interior. Although the discharge still moves and glows, much of the discharge can be buried too deep in the glass to look interesting. The tubing can be almost any shape, however the tube must be filled with glass pieces later, so anything with sharp bends will be difficult to fill. After bending the outline of the tube, seal one end by attaching an electrode. The second electrode is left off until after filling with the glass.

Q Does it not affect the neon inside the tube?

A Any fill material used must be thoroughly cleaned. A tube filled



with beads, for example, will usually have many times the surface area of fill material than the outside glass envelope. Even a small amount of impurity on the beads adds up quickly and can poison the gas fill later. The ideal cleaning method is to rinse all the glass with a strong reagent-grade solvent to lift any oils or

grease-like contaminants. Then a weak solution of hydrofluoric acid is used, followed by a thorough rinsing of distilled water, and then hot air drying. One other caution: Electrode shells shouldn't be in contact with the filling media. This requires some form of baffle, either dimples in the electrode neck or "necking down" the electrode glass so that the glass media won't pass through. The tube will operate without this cautionary step, but may not operate very long.

Q How do I finish the crackle tube?

A With the tube filled and the electrodes sealed on, the tube needs to be baked in an oven. The baking further outgasses the tubing and fill media. Preferably, the oven temperature should be nearly the annealing point of the glass tubing. After baking for at least a half hour (and while the tube is still hot), the tube can be removed from the oven and put on a vacuum manifold for evacuation. A crackle tube can't be evacuated like an ordinary neon tube, because the bombarding current would unevenly heat the tube, causing some parts to suck in while others wouldn't even be hot.

After oven heating, the hot glass filling media will hold a great deal of heat for a good length of time, which will aid pumping. Use an induction heater to heat the electrodes for outgassing and converting the shell coatings. This should be done quickly while the rest of the tube is as hot as possible to prevent re-absorption of the gases.

After thoroughly heating and evacuating, fill gas can be put in. Neon is the best choice, because it is the brightest gas available. Argon or neon with mercury is often a problem, because mercury seems to darken readily over time in this kind of tube. Other gases krypton, xenon and helium) really don't give much light, and helium gets very hot.

The filling pressure is not the same as filling a conventional neon tube. Depending on the activity level desired, the tube can be filled from 20-100 torr. The higher the pressure, the more active the tube. With higher pressures, the tube will also require significantly higher voltages and take longer to age in. To power a crackle tube, a conventional core-and-coil transformer works best. (Try a solid-state transformer, and you'll quickly see why they're not used. Instead of thin discharges, some solid-state units light everything in the tube, preventing the lightning effect.) Crackle tubes are somewhat time consuming to make, but they add a visually appealing kinetic action that can add dazzle to signs or art pieces.