Ultrasonic welding of plastics

In 1960, Sonobond Ultrasonics Co. (USA) developed the first ultrasonic welding machine suitable for joining metals in the aircraft industry. The use of ultrasonic welding has since spread throughout a variety of manufacturing areas, for example, packaging, medical, aerospace, automotive, toy, computer and electrical industries. Ultrasonic welding can join many materials, for example, small welds in copper, nickel and aluminium, but is most often used for joining plastics and is particularly efficient when joining dissimilar materials.

Today, ultrasonic welders which can spot weld and seam weld any plastic material in seconds are just becoming available for educational use.

Ultrasonic welding of plastics involves holding two plastic surfaces under pressure between an anvil and a sonotrode (Figure 1). The latter applies mechanical vibrations to the weld area. Ultrasonic frequencies between 15 – 70 kHz are used. Welding is due to local melting as a result of absorbed vibration energy. Ideally, both pieces to be welded should have close/similar melting points. Because the energy transferred and the heat released across the weld is constant, the weld quality is very uniform.

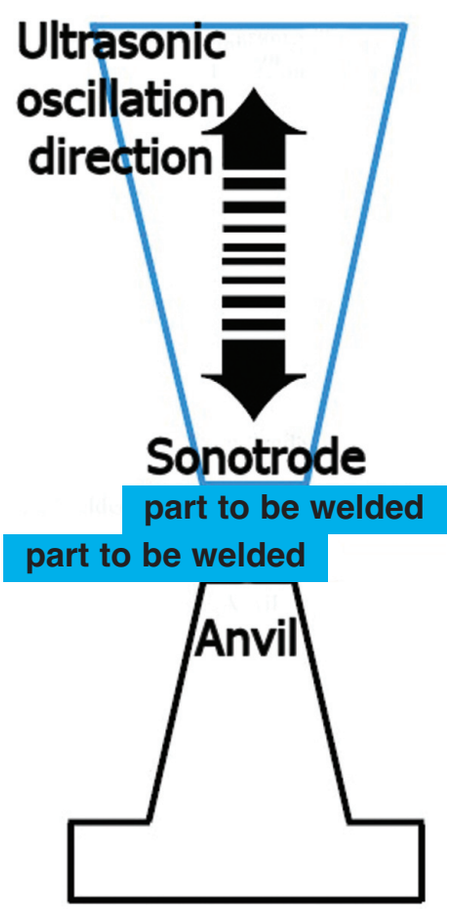

Figure 1 *- cross section of an ultrasonic welder*

Figure 2 *- The Solar-Sonic Ultrasonic Welder*

Notice in Figure 1 when welding plastics, the direction of vibration is vertical (90°) to the plastic surface, for welding metals the direction of vibration is parallel to the metal's surface. Hence, sonotrode design for metal welding is different from that required in plastic welding. Materials which are too thick will not weld. Ultrasonic welding is a fast method of joining materials which can also be easily automated. Weld times, typically of a few seconds or less require no LEV (local exhaust ventilation system).The anvil's shape determines the size and shape of the weld.

The Solar-Sonic ultrasonic welder illustrated in Figure 2 was designed specifically for use in educational establishments. It operates at around 35 kHz and the arm allows for welding of material up to 300 mm long.

Unfortunately, at present to set up ultrasonic welding in a school department would cost typically £2950 + VAT, that's including educational discount! Cost represents the complexity of the electronics and other systems within the sonotrode. Great technology! but currently an item for our 'dream on' list! until at least, the price becomes affordable to educational establishments.

Useful Websites:

www.solarlasers.co.uk
www.solar-imaging.com