An Improved Clamp For Gluing TEM Cross Section Samples

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It is crucial to get a thin glue line when making TEM cross section samples, so normally a clamp is used to press the samples together during curing. Several types of clamps are available commercially, however almost all of them have a big disadvantage: the pressure cannot be adjusted. Basically there are two types of clamps. Type 1 is a small vise that uses a screw to press the samples together. There are two problems associated with type 1. The first one is that usually the viscosity of the glue decreases during the initial stage of curing, so even if you had tightened the screw hard, the sample could still get loose because the glue becomes thinner as its viscosity reduces. To get a thin glue line with this type of clamp, one has to keep retightening the screw when the clamp and sample is being heated.

The second problem is that it is very difficult to adjust the pressure. Because both clamp and sample do not yield when being tightened, it is very likely that even only an extra half turn of the screw will crack the sample.

Type 2 clamp uses a spring to give pressure. This type of clamp is essentially a binder clip. With this clamp it is not possible to adjust the pressure exerted on the sample. So when the pressure is just right for sapphire, it may be too much for GaAs. And when it is OK for M-bond, it may be too little for Gatan G-1. Furthermore, if one needs to glue a very thick sample or several more pieces together, the clamp gives a much higher pressure than it does for thinner samples.

To solve these problems, we designed a different spring clamp, which is shown in the figure below. This clamp uses two Al blocks fixed at the ends of a Teflon coated base and two movable Al blocks in the middle. The two movable blocks are also Teflon coated to prevent the sample from sticking to them. These blocks slide over 2 steel guide rods which are fixed to the end blocks. One of the movable blocks is connected to the knurl head screw and the other is pushed from behind by a set of springs. A marker is attached to the second Al block to indicate pressure. Using this clamp, it is possible to control the pressure very precisely by turning the knurl head screw forward or backward. One can always read the pressure from the scale and it will not change during the curing process. In addition, regardless of how thick the sample is and how many pieces are to be glued together, one can always get the correct pressure according to the readings in the scale. Each value in the scale always corresponds to a specific amount of pressure no matter how thick is the sample or how many pieces are glued together, so that one can have specific settings for each type of sample, for example, 3 for Si, 2 for sapphire and 4 for GaAs.