

number of pixels on the screen or in a printed image. If the software maps images to the screen pixel by pixel, the image collected at a given magnification will be bigger on the screen and each pixel will represent a smaller dimension. The same software will probably print the image the same size, and the question will be whether your eye will be able to appreciate the finer detail. It will offer larger prints (or more zoom) before pixel jaggedness appears to the same degree. For image analysis, the pixels will be finer at a given magnification (field of view). Therefore, one should be able to perform measurements on smaller features than before.

Silicon Cross-Section Sample Preparation (Cleaving)

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I have found the best way to cleave [001]-oriented silicon wafers is rather different compared to GaAs or InP. The problem is that Si prefers to cleave on (111) planes rather than (110) and so one gets an angled face with the cleave, which is usually rather uneven and often doesn't run straight. This is even worse when cleaving close to an existing edge, which attracts the crack front as it propagates. Good for making low-angle cleaved specimens, but a problem otherwise. It is possible to make Si cleave on (110) by cleaving the wafer without any support.

So, to cleave Si on (110): make a single scribe mark on the top surface with a good sharp diamond a couple of millimeters long at the edge of the wafer along the $[\bar{1}10]$ direction. Then, hold the wafer just between forefinger and thumb in both hands, with the top wafer surface under the fingers and the scribe mark between the fingertips. Put a thumbnail under the scribe mark and then bend the wafer down, pulling apart slightly at the same time. If it cleaves well, it will do so very quickly with an audible 'ping'. It's a good idea to do this over a large clean surface in case either part is dropped.

This is not hard to do on a whole wafer (although trying not to drop an eight inch wafer is fun), but as the pieces get smaller, it gets more difficult. It should be possible to get an 8 mm wide strip, but a 5 mm strip might be difficult or impossible. A wafer could be back-thinned, but of course this isn't straightforward for something more than one inch in diameter, and any scratches on the back might make the cleave deviate from its path. Like a lot of these things, it's a lot easier to demonstrate than describe in text, and it takes a little practice to get the hang of it. I would try it on a few spare wafers first. A ten millimeter wide strip could be cleaved and then ground down to a couple of millimeters before mounting for SEM.

The {110} planes lie perpendicular and parallel to the major flat or notch on a Si wafer, and of course there's no point trying to cleave a wafer along any other direction but the $\langle 110 \rangle$.

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