

Making Anaglyph Images From SEM Images Using Adobe PhotoShop

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Three-dimensional images, or anaglyphs, can provide useful information as to height relationships between components of an image. They can also enliven presentations before diverse groups. Imagine a boardroom full of executives having their 5th straight meeting of the day. You are there to present preliminary research information that could lead to a major contract. After requesting that everyone to put on red/blue glasses (not exactly the height of fashion), you proceed to show stereo images of hair samples with obviously different degrees of roughness. Correlation is drawn between the different samples and the nutritional components of the dietary supplement being tested. A picture not only saves a lot of words. It also leaves a lasting image in the minds of the observers that could easily translate into \$\$\$\$. Besides, it's fun to look at neat 3-D images!

Below is a method for converting SEM stereo pairs into anaglyphs using Adobe PhotoShop 4.0 or higher. The actual conversion steps take just a few minutes with most of this effort needed to produce properly aligned images. Some recent SEM models have software to do this for you. However, this method works well for those working with older equipment.

Procuring, Processing and Aligning Images:

1. Take a pair of digital or photographic images that differ from 4 to 14 degrees in tilt. The amount of tilt will depend on sample topography and magnification but a 7 degree tilt is a useful starting point. Scan photographic images into your computer using resolutions of 300-600 dpi.

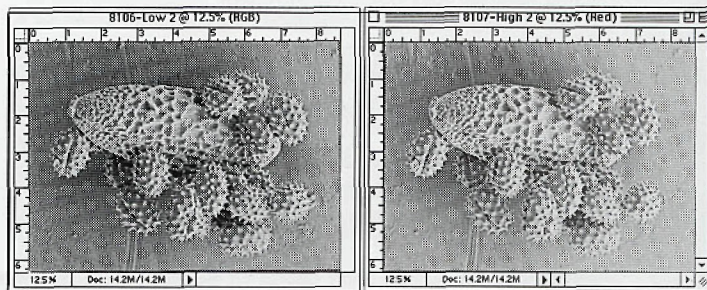
Hints:

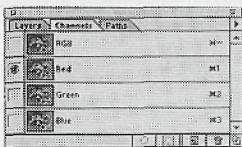
- a. Use stage rotation, not image rotation, for adjusting image position so as not to displace normal "highlight and shadow" locations on the images.
 - b. After tilting the sample, refocus using the stage Z axis control (not the final lens focus control) to avoid image magnification and rotation changes.
 - c. When choosing an area to record, try to have some recognizable detail in the center of the image. Use this point to reposition the second image after tilting to get a similar field of view. This will also make stereo reconstruction much easier.
2. Adjust image size if necessary. Many digital programs will save images at low DPI (i.e., 72 dpi) and large horizontal and vertical size. I suggest that you resize to the average area of a Polaroid image (i.e., 4.4" x 3.3"). Do a corresponding increase in resolution to 300 dpi or higher.
 3. Adjust your image files so they have similar contrast and brightness using the Levels dialog box (Image>Adjust>Levels).

4. Open a new canvas with the resolution set the same but the dimensions slightly larger than your images. Select the image mode "RGB Color". Name this file "**Working**".
5. Select the desired area from your low angle image (**Low 1**) using the rectangular marquee tool. Copy this area and paste it into the "Working" canvas. Do not remove the selection marquee from Low 1.
6. Add a new layer to the "Working" canvas called "lines". Draw a black line approximately 6 pixels wide in each direction to mark the center of your canvas. Hint: if you depress the shift key prior to starting to draw the line, it will automatically be straight.
7. Now drag the selection marquee from Low 1 to your high angle image (**High 1**) so the same general area is framed. Copy this area and then paste it into your "working" canvas. It will automatically go into a new layer in front of your "lines" layer.
8. Reduce the opacity of the High 1 layer to 50% (top of layers dialog box). Now you can see the lines and the low angle image.
9. Adjust the position of the High 1 using the move tool and your arrow keys (on keyboard) until the center is aligned with the center of the Low 1.
10. Using your marquee tool, select the area of your high angle image that overlaps the low angle image and copy. Open a new canvas – it will be the same size as the image just copied and in RGB mode. Paste the high angle image into this canvas, save and label this file as "**High 2**".
11. Now click on the low angle image layer in the "Working" layer dialog box to make it active. The marquee selection area will now be active for this layer and you can copy this selection into a new canvas and save it as "**Low 2**". You have now produced two RGB files of identical size containing the images that have been perfectly aligned with each other at the center.

Combining images to produce an Anaglyph image

1. Adjust the size of Low 2 and High 2 so they can be positioned next to each other on your monitor.



2. Select the channels dialog box (usually in the same dialog box as your layers). You will now see 4 channels in your dialog box; one for each primary color and one RGB channel which combines all 3 colors.
 
3. Select the entire Low 2 image. Then select the RED channel and **cut** to remove this channel.
4. Select the entire High 2 image. Then select and **copy** the red channel.
5. **Paste** the red channel from High 2 into the empty red channel in Low 2.
6. Now select the RGB channel in Low 2 and look at the resulting image with red-blue stereo glasses. The red filter should be over your **left** eye. You will now see a stereo Anaglyph image. This file can be sent to a color printer or digital slide maker or projected using an LCD panel or digital projector. ■

Inexpensive red/blue stereo glasses can be ordered from numerous sources such as:

Reel 3-D Enterprises, Inc
P.O. Box 2368
Culver City, CA 90231
Phone and FAX: 310-837-2368
Item# 7001

Ted Pella, Inc.
4595 Mountain Lakes Blvd.
Redding, CA 96003
Phone: 1-800-237-3526
Item# 1121-4

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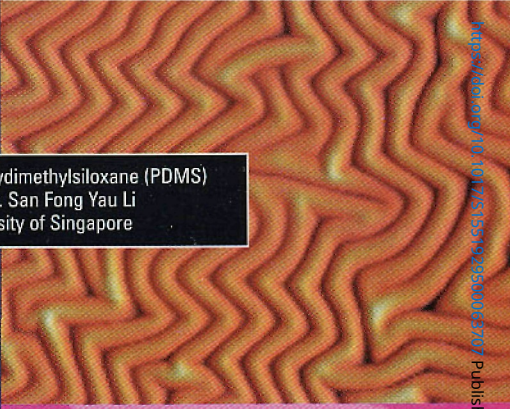
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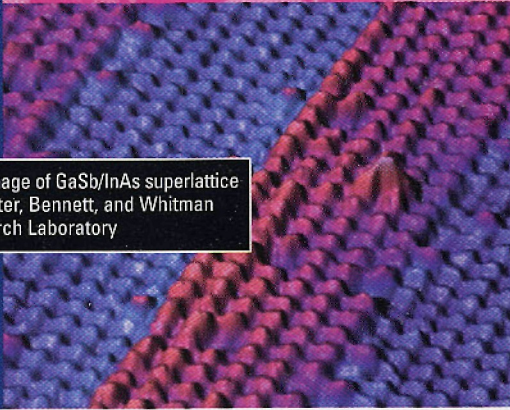
Microscopes.



A 6µm AFM image of polydimethylsiloxane (PDMS)
Courtesy of Prof. San Fong Yau Li
National University of Singapore



A 14µm LFM image of a thiolipid monolayer on mica
Courtesy of Delphine Gourdon
EPFL



A 300Å cross section STM image of GaSb/InAs superlattice
Courtesy of Barvosa-Carter, Bennett, and Whitman
Naval Research Laboratory

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