

Review: Amscope Metallurgical Trinocular Microscope

Michael Reese Much FRMS EMS
Bethlehem, Pennsylvania USA

Amscope is an importer and distributor of microscopes and microscopy products and accessories located in Irvine, California USA. Their website address is www.amscope.com. They also have a profound presence on eBay. When I went to their website and looked at their list of customers I was amazed at who they are serving.

Metallurgical and petrological microscopes differ from other light microscopes in that they do not illuminate their subjects with transmitted light since their subject matter is opaque – light cannot pass through it (unless, of course, a petrological specimen is ground very thin and can pass light). These scopes illuminate the subject through axial illumination – they use a system called an epi-illuminator which projects light through a beam splitter, which directs the light down through the objective onto the subject on the stage. That image is then projected back up through the objective to the eyepieces and/or camera. It is shadowless lighting and allows illumination at very close working distances where the use of fiber-optic illuminators is impractical.

THE MICROSCOPE IN GENERAL

The scope under consideration in this review is one of many metallurgical models available from Amscope. The models vary by the design of the stand, the objectives provided, the epi-illuminator used, and the model of the camera.

In the billing, Amscope identified this model as a ME-300T-3M, the "3M" presumably identifying it as having a 3 megapixel camera in the bundle. The enclosed instruction booklet identifies the model as a "Metallographic Microscope XJP-H100."

When I purchased it in 2012, the price was \$799 USD.



THE TRINOCULAR HEAD

The interpupillary distance of the eyepieces can be adjusted from 53 to 75mm. The microscope kit came with two Plan WF10X eyepieces and two Plan 16X eyepieces. The field of view for the 10X is 18mm and for the 16X it is 11mm.

Each eyepiece tube has its own dioptic focusing ring so the scope can be made parfocal for each eye.

The shaft on the side of the head moves a beam-splitting prism assembly in and out of position. When the shaft is pushed in in the image only goes to the eyepieces. When the shaft is pulled out, the image is split between the eyepieces and the camera tube. I couldn't find a specification, but it looked like the split may be 40% to the eyepieces and 60% to the camera.

The addition of the epi-illuminator between the stand and the trinocular head raises the eye point of the eyepieces to an uncomfortable level on a normal height desk or counter.

The camera is mounted to the phototube like an eyepiece and can be freely rotated to align the sensor squarely in relation to specimen.
(Quality note: After about a year the metal label showing the prism position came off and had to be re-glued).



THE EPI-ILLUMINATOR



The illuminator is inserted between the trinocular head and the microscope frame. It can be positioned to any point in an arc around the frame independent of the head. From left to right:

There are two screws for centering the condenser, just as in transmitted light microscopes, at roughly the ten and two o'clock positions on the illuminator barrel. The lever with the ball on it to the right of those screws controls the field diaphragm. I have found the easiest way to center the condenser is to open the software and open the live view function. Then stop the field diaphragm down to its smallest aperture and center the condenser with the centering screws. Then open the field diaphragm to the desired aperture for shooting.

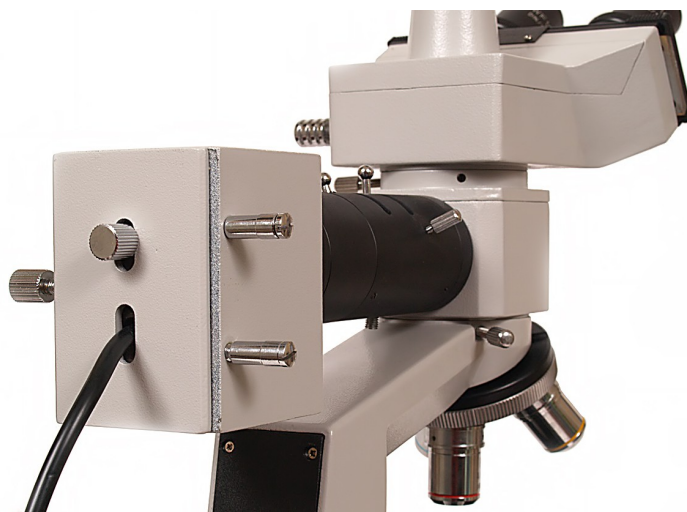
The lever to the right of the field diaphragm is the aperture diaphragm. Just before the lamp house are two slots for the filters that came with the scope.



I have other Amscope microscopes, and these seem to be an obligatory set with all of them. The blue one is an 80B and is used to correct for tungsten lighting, which can easily be done in the camera software. The green filter is used to reduce chromatic aberration in lower quality objectives. A yellow filter is commonly used in black-and-white photography to subtly define clouds against a blue sky, but I have yet to find an application for it in microscopy.

THE LAMP HOUSE

The lamp house provides screws for positioning the halogen lamp in relation to axis of the illuminator. When I first assembled my scope I was frustrated with how dim the image was until I realized it was necessary to align the lamp with the illuminator. Again, this can be best accomplished by viewing the process in the camera software.



THE STAGE



The stage has 5 cm of vertical travel, so it can accommodate some gross specimens. It has 70 mm of transversal movement and 30mm of longitudinal movement. (Quality note: One day I found the small reference scale next to the longitudinal scale on my desktop. It had to be re-glued).

OTHER CONTROLS



The power control knob is on the base of the frame. It has the feel of a potentiometer rather than a rheostat. The fine focus knob has graduation and number markings cast into the plastic, but since they are unpainted they are pretty much useless.

THE OBJECTIVES

The scope shipped with three objectives: a 4X, a 10X and a 40X.



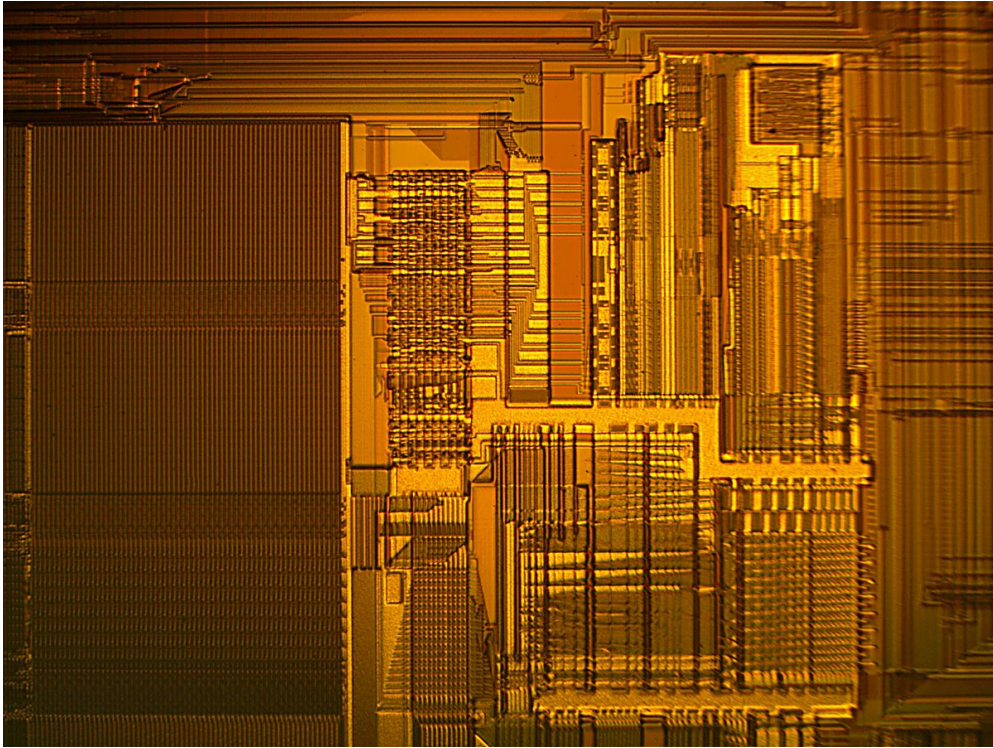
The manual describes these as being "Plan-achromatic objectives", but from the lack of field flatness I have found I find that description a bit optimistic. Because of the curvature of field I have found (especially with the 4X) I get my best results focus-stacking sets of images.

Objective	Numerical aperture	Working distance
4X	0.1	13.8mm
10X	0.25	11.2mm
40X	0.65	0.62mm

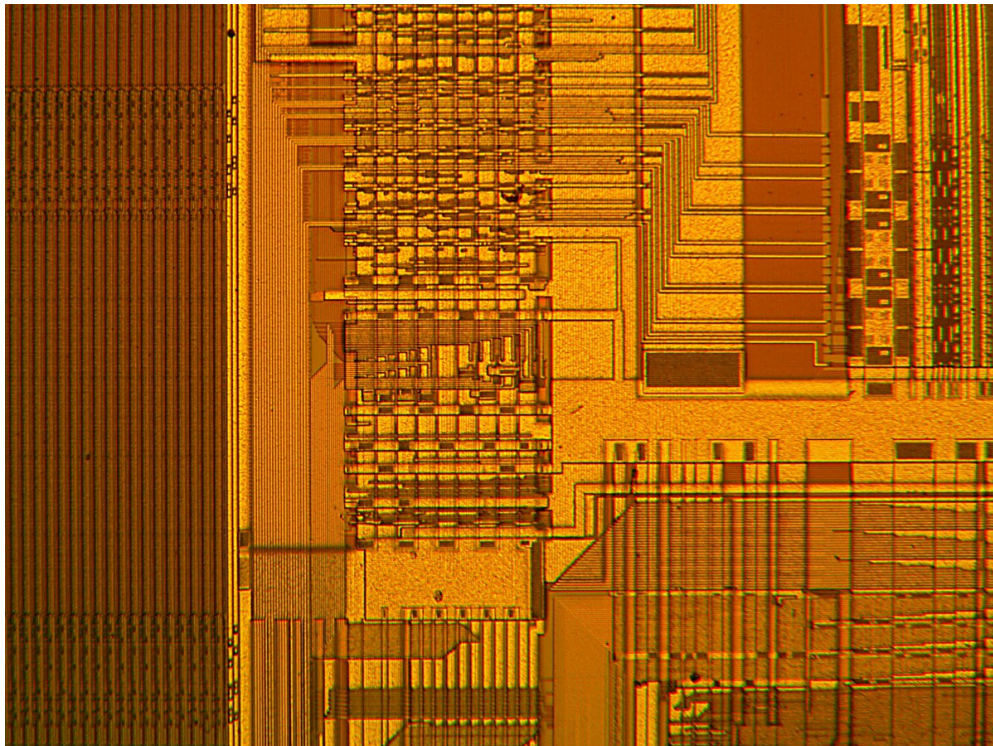
(Quality note: After only about three years I am starting to see some rust on the barrels, so apparently the chrome plating isn't very strong.)

Here are some test images made on an Intel Pentium 1 microprocessor. You will see some fall-off with the 4X objective and some green and red chromatic aberration in the 10X and 40X.

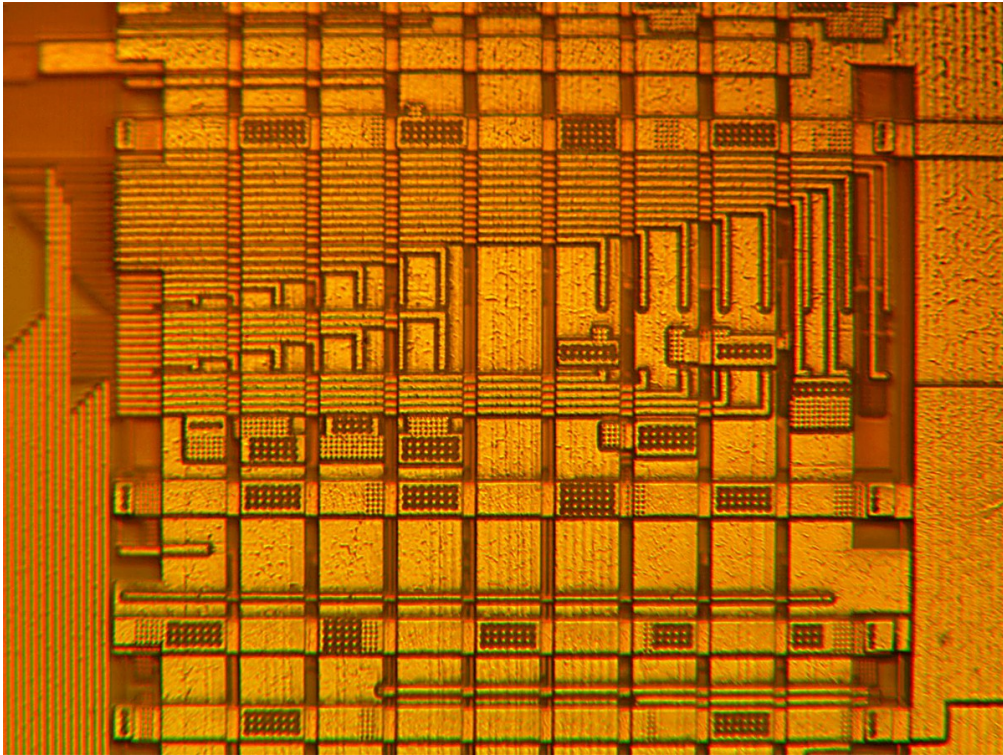
4X OBJECTIVE



10X OBJECTIVE



40X OBJECTIVE



THE CAMERA



The digital camera is a 3.1megapixel CMOS C-Mount camera model number ToupTek UCMOS03100KPA from ToupTek Photonics. The Aptina sensor area is 6.55mm x 4.92mm with a pixel pitch of 3.2 microns.

The camera connects to a computer with a standard USB 2.0 printer cable.

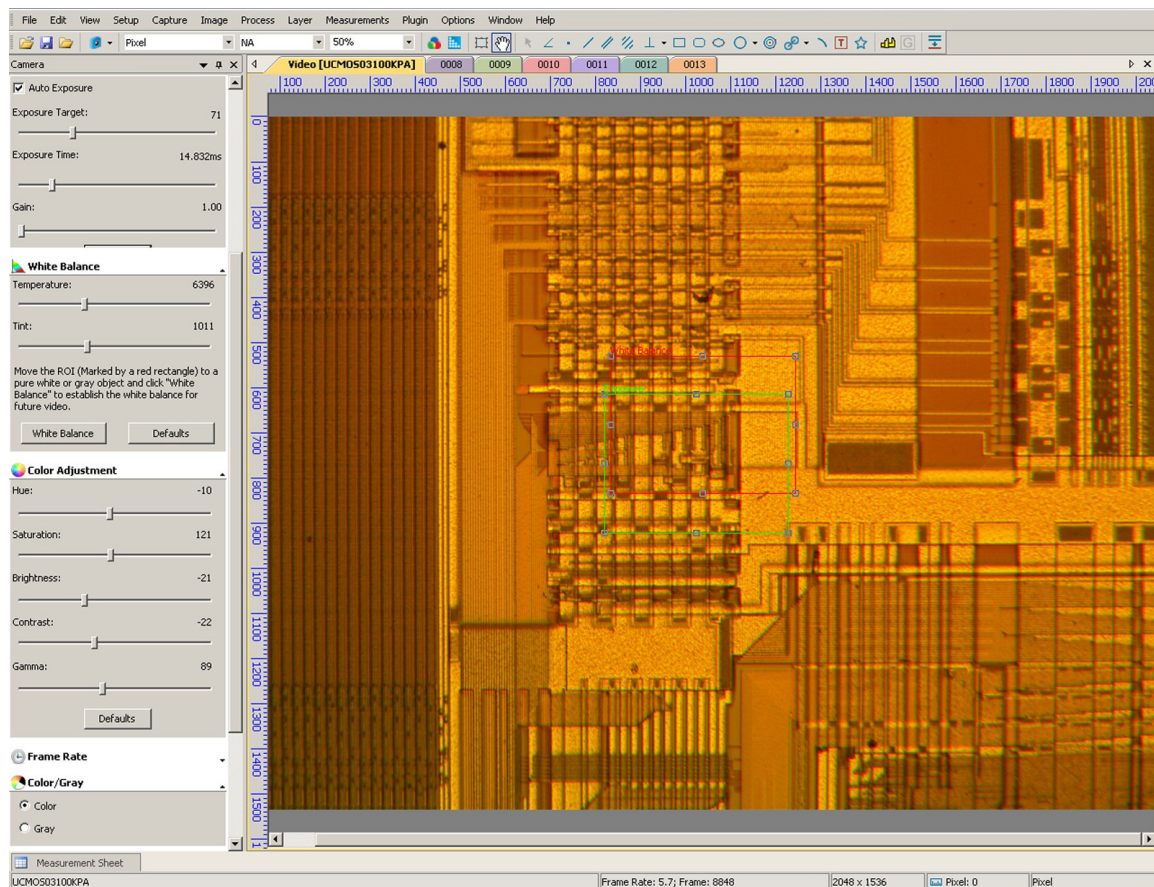
The camera adapter lens is one of four available for this camera The barrel is marked "5mm" and the specifications note that the lens has a 0.50X reduction ratio.

The sensor is remarkably noise-free.

As I noted above, since this fits into a 31.75 eyepiece tube, it can be freely rotated to be aligned squarely with a subject.

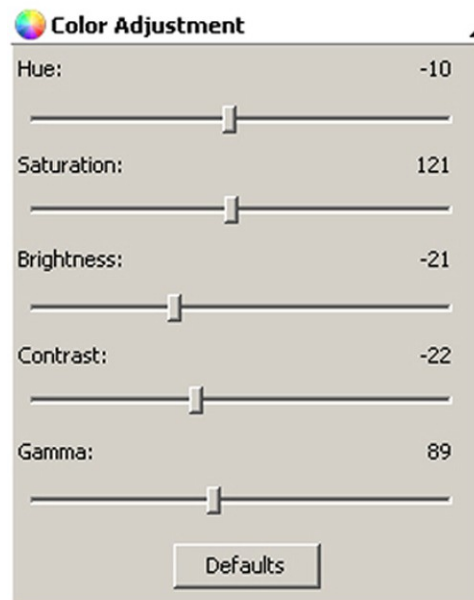
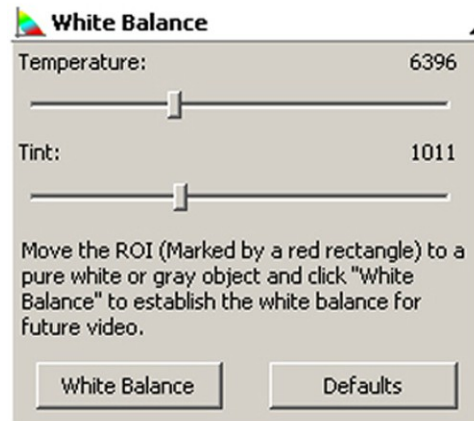
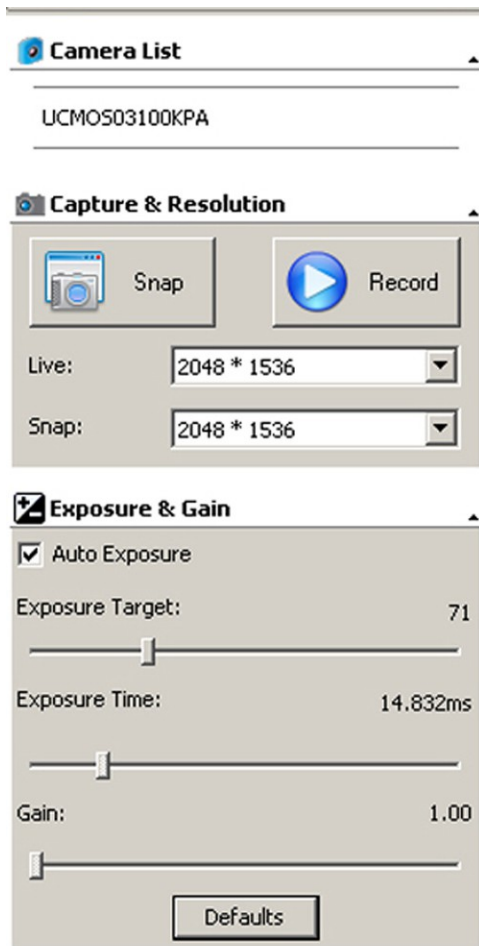
THE SOFTWARE

The microscope originally shipped with ToupView 3.2, but after conferring with Amscope technical support about some problems I was having, they sent me a copy of ToupView 3.5. My compliments on the quality of Amscope technical support.



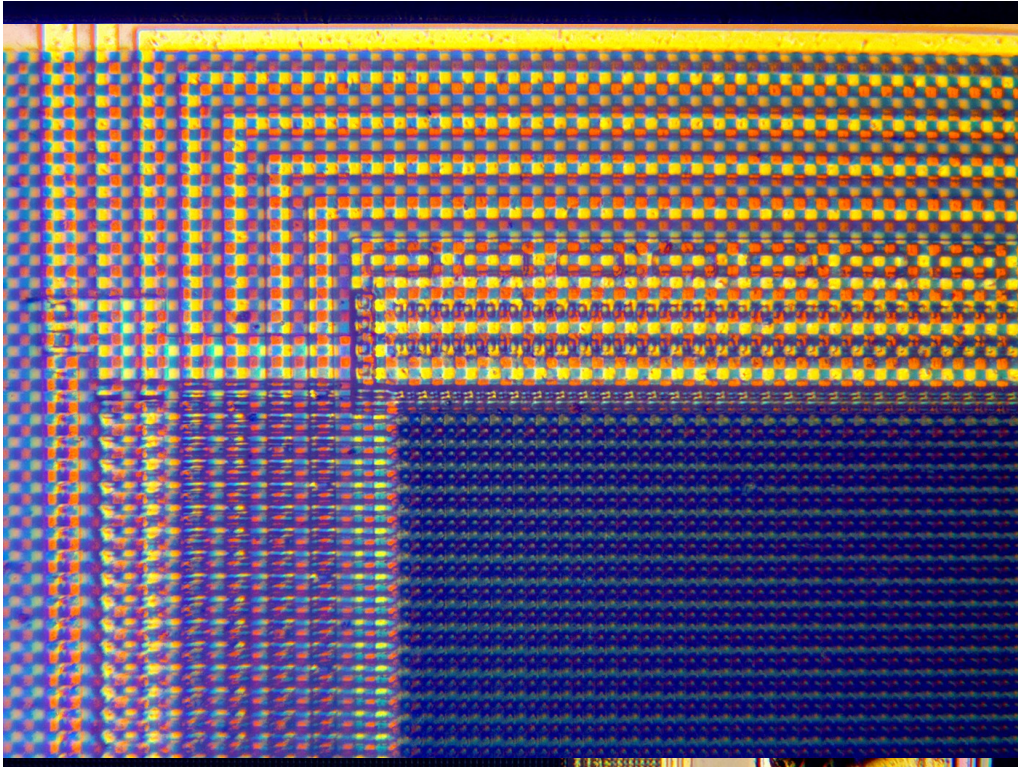
In some respects it is less than user-friendly, but it has many options that, quite frankly, overwhelm me. It can shoot stills or video, and by clicking on the large yellow tab just above the main window it will display a real-time live view of what the camera is seeing. At higher resolutions, the frame refresh rate can be a bit frustrating. It also allows you to view at up to a 400% view to facilitate fine focus on the microscope.

I haven't found a way to do a batch "Save As" and so far I have to click on each image to save it, at which point I have to type in the individual file name (e.g. ToupView - 0012) into the destination folder to save it. If I'm doing a focus stack of 25 to 40 images, this can be quite cumbersome.

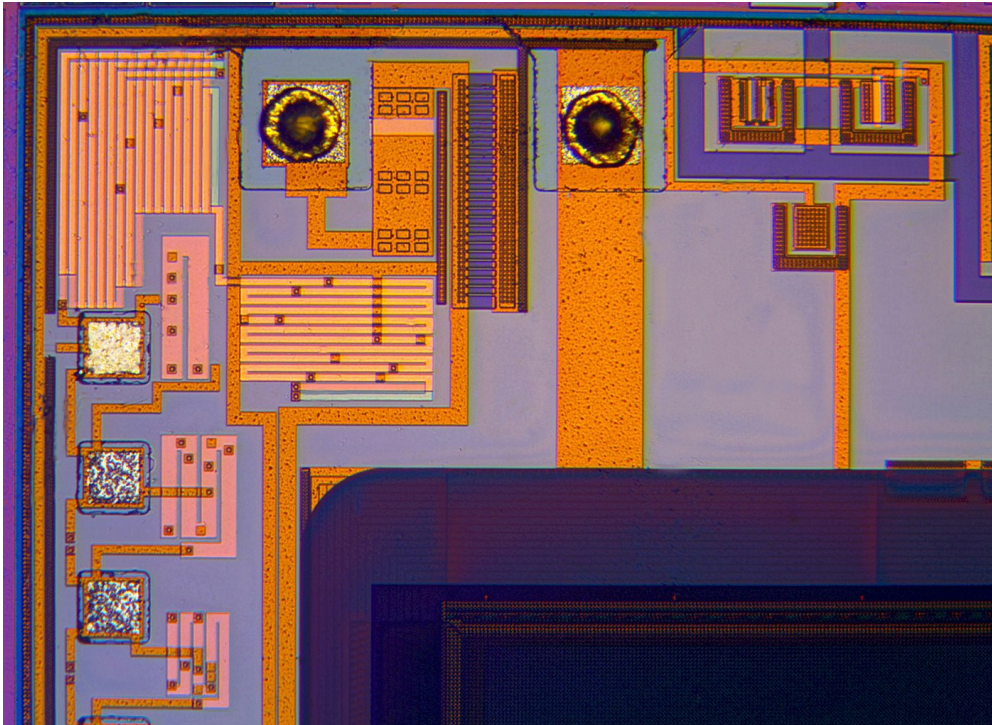


Here are two details of some of the exposure controls. The "Snap" is the shutter button for stills and the "Record" starts video recording. The "Temperature" option is very sensitive and the Kelvin numbers it uses don't make any sense. For example, a Kelvin temperature might be an iridescent green. I have found I'm better off doing a white balance from a gray card slide I made from a paint sample chip from the hardware store. Even though ToupView provides with a real time live view, once you start shooting you might be better off tracking your focus through the eyepieces, especially if you are shooting images for a stack. I find I am getting very good results with stacking to make up for field flatness and depth of field problems inherent in photomicrography. A newcomer attempting to get fine images with a setup such as this may be frustrated in comparison to an experienced microscopist. So, in all fairness, I have included some images of CCDs shot with this Amscope, stacking series, and Zerene Stacker software.

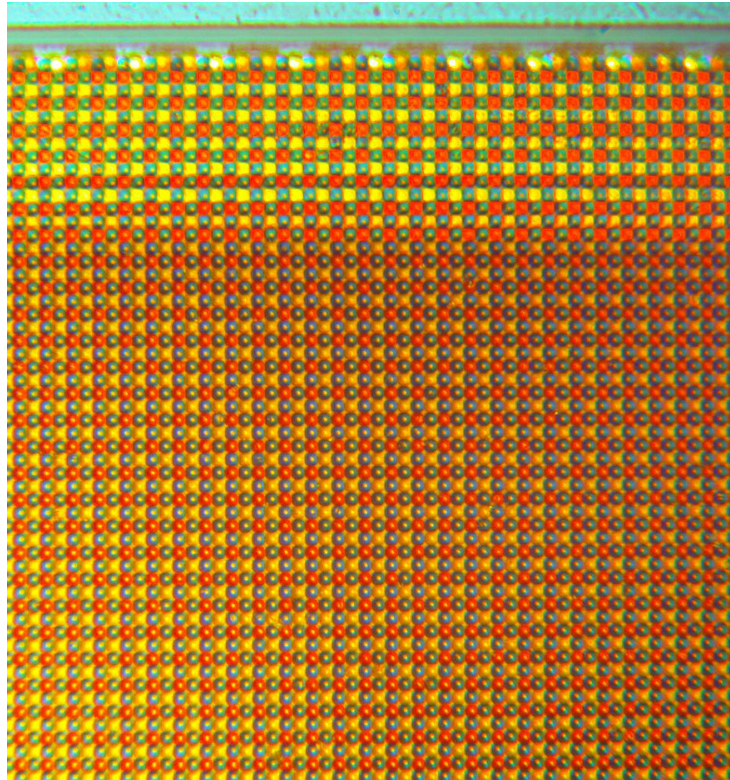
Panasonic 39470



SHARP RJ-2353



SONY ICX284



My final judgement? I have been happy with the results I am getting for the money invested. Certainly I have been less frustrated than when I tried to get decent images out of a stereo microscope and I don't really shoot opaque subjects as often as I do translucent ones, so on those rare occasions, and having mastered this scope to the degree I have, I'm satisfied.

Michael Reese Much can be contacted at: Amoeba1 AT rcn DOT com

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