TRANSMITTED OR REFLECTED ILLUMINATION PART 2: DIY LIEBERKÜHN MIRROR

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INTRODUCTION:

Last month I presented an article that was accepted in *Micscape* to describe the use of the reflections created by the front of microscope objectives when they are chrome and to take advantage of this for epi-illumination of opaque objects.

When my article was accepted and the link to the article in *Micscape* was sent to me by the editor David Walker, he made the following observation:

"From your own trials you have discovered a simpler version of what the Victorians used to do, they put a curved mirror collar around the objective to reflect light back and was called a Lieberkuhn mirror. A mirror was shaped at the correct focal length for each objective. The specimen was mounted on a black disc to block the direct light."

Before this observation, I had not heard of LIEBERKÜHN MIRRORS and if I had, I did not remember at the moment of thinking of the article.

So inspired once more by the words of David Walker, editor of *Micscape* and author of many interesting and inspiring article in different topics of microscopy, I thought of the possibility of creating my own LIEBERKÜHN MIRRORS because although they were used years ago are not well known by most microscopists.

In addition, they represent a great tool to do epi-observations that as I have emphasized in my several articles about epi-illumination it expands the range of objects to observe.

The question is: What are LIEBERKÜHN MIRRORS?

They are parabolic, better said, concave reflectors similar to the ones found in battery operated lamps which have the purpose of reflecting the light of the bulb toward the front amplifying in this way the angle of dispersion of the beam.

LIEBERKÜHN MIRRORS were name after J.N. Lieberkühn a German anatomist who both designed and used them. They are placed around the microscope objectives.

These mirrors when applied to microscopy have the advantage of reflecting back upon the object, light sent from below the sample, allowing in this way to observe opaque samples that are not possible to observe with just transmitted light.

An explanation of them can be found in an article in the September 1998 issue of *Micscape*: Incident Lighting and the Lieberkühn Speculum by the late William Ells of Maidstone, Kent, UK.

The second question is that if they are so useful:

Where can we find by ourselves LIEBERKÜHN MIRRORS?

The answer to this question is very easy, they are everywhere at home, at home? Yes they are. See below.

DEVELOPMENT:

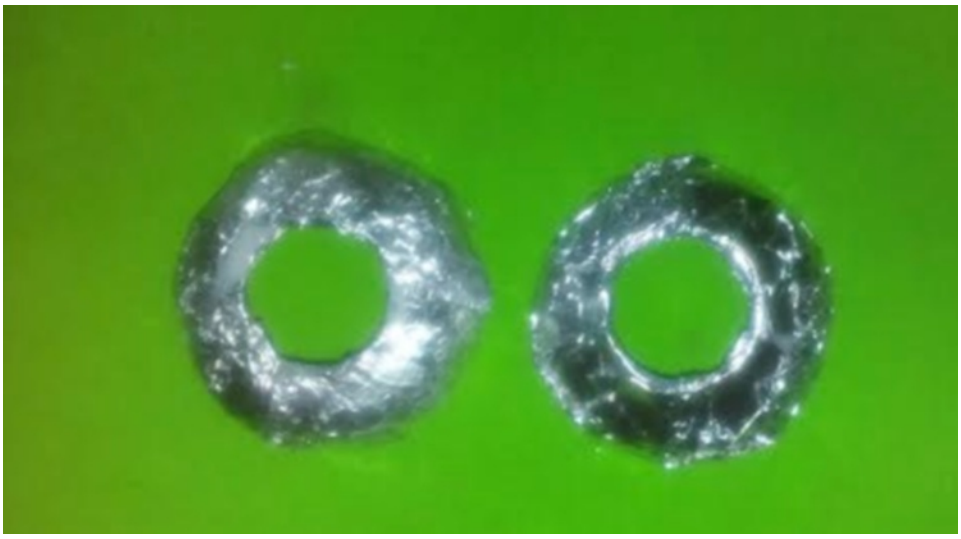
For doing this experiment the first step was to look for parabolic, chrome objects but I found none.

I decided to create them by myself so again looking around I found that some bottles, for example water bottles or ethanol containers of the type used in medicine, could be cut into parabolic forms if the superior part of the bottles is removed and if they had already suitable aperture to pass the objective.

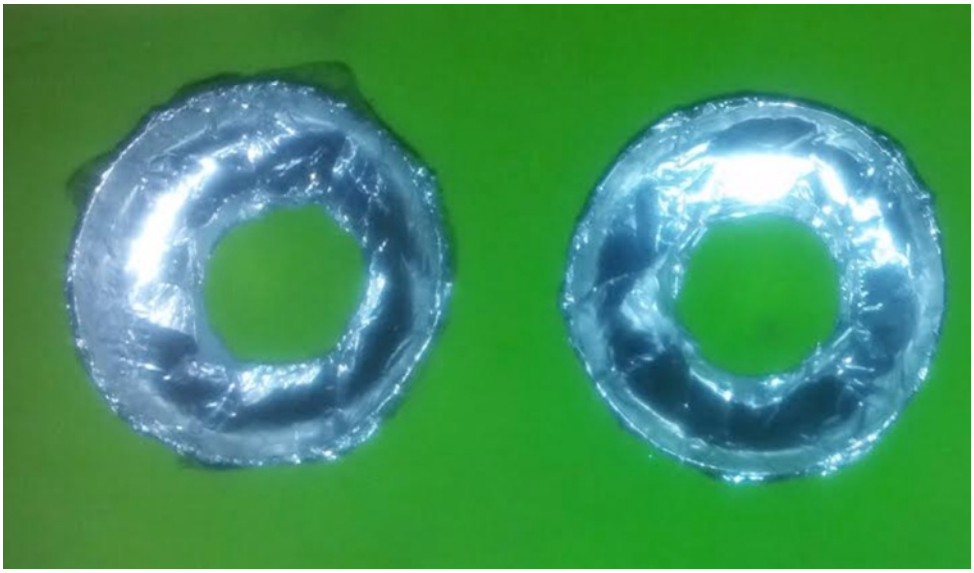
The next step was to adapt the hole of the container to the perimeter of the objective so that by itself might be a tight fit to it and because it is made of plastic no damage or scratching is made to the surface of the objective.

The second step was to wrap the parabolic reflector made of plastic with something chrome, I used for this some aluminum foil. I made two one for each objective.

This way:



The external part of the mirrors:



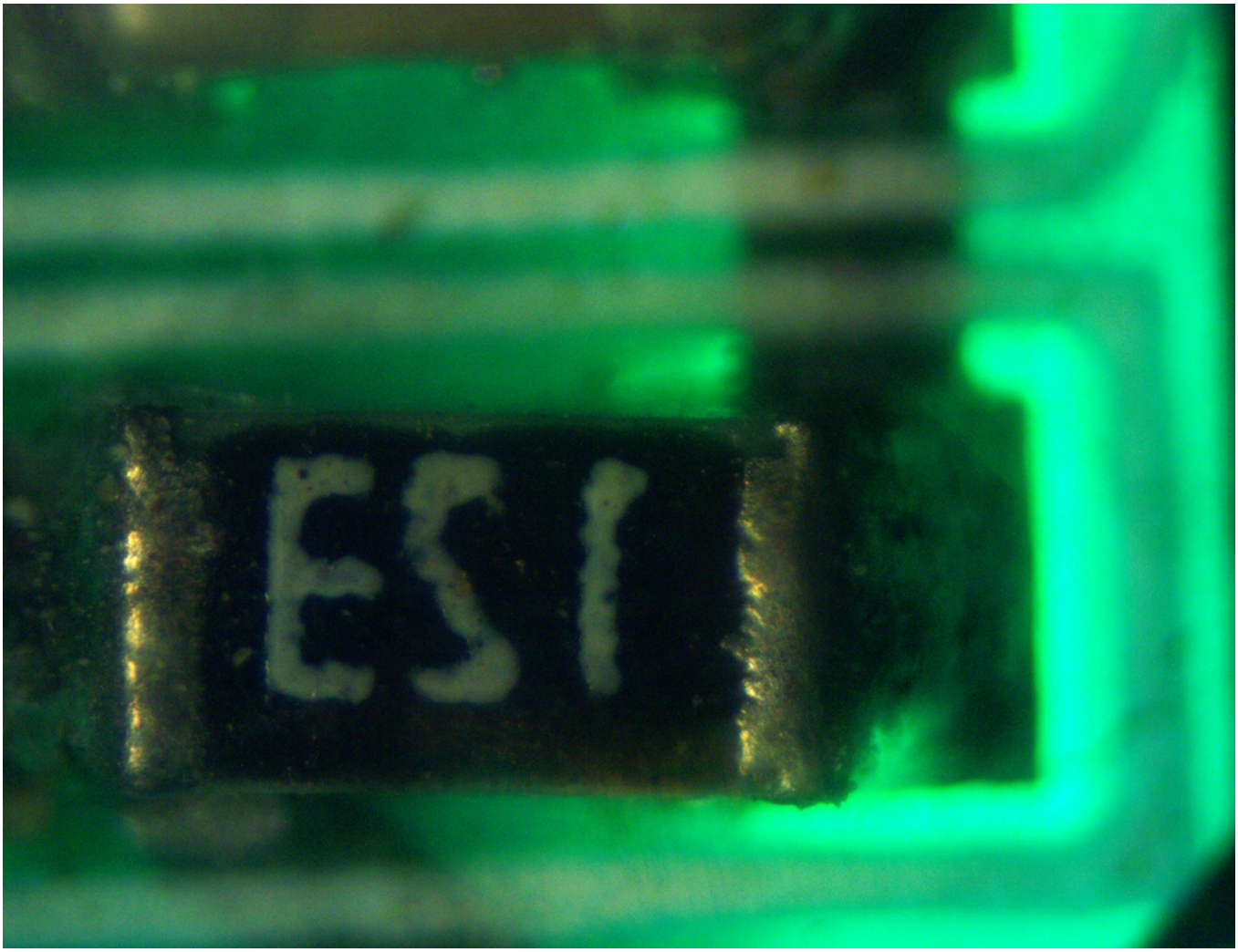
Finally I fitted them upon the objective 4x and 10x because of the advantage these objectives have of space beneath them. I turned on the built-in illumination system of my microscope and place upon a slide some opaque objects, again I used coins because they are “big”, opaque and metallic, but anything can be employed.

For “thin” objects, such as needles that allow direct transmitted light to pass by it, an opaque piece or cardboard is needed to avoid a lot of light that overwhelms the image.

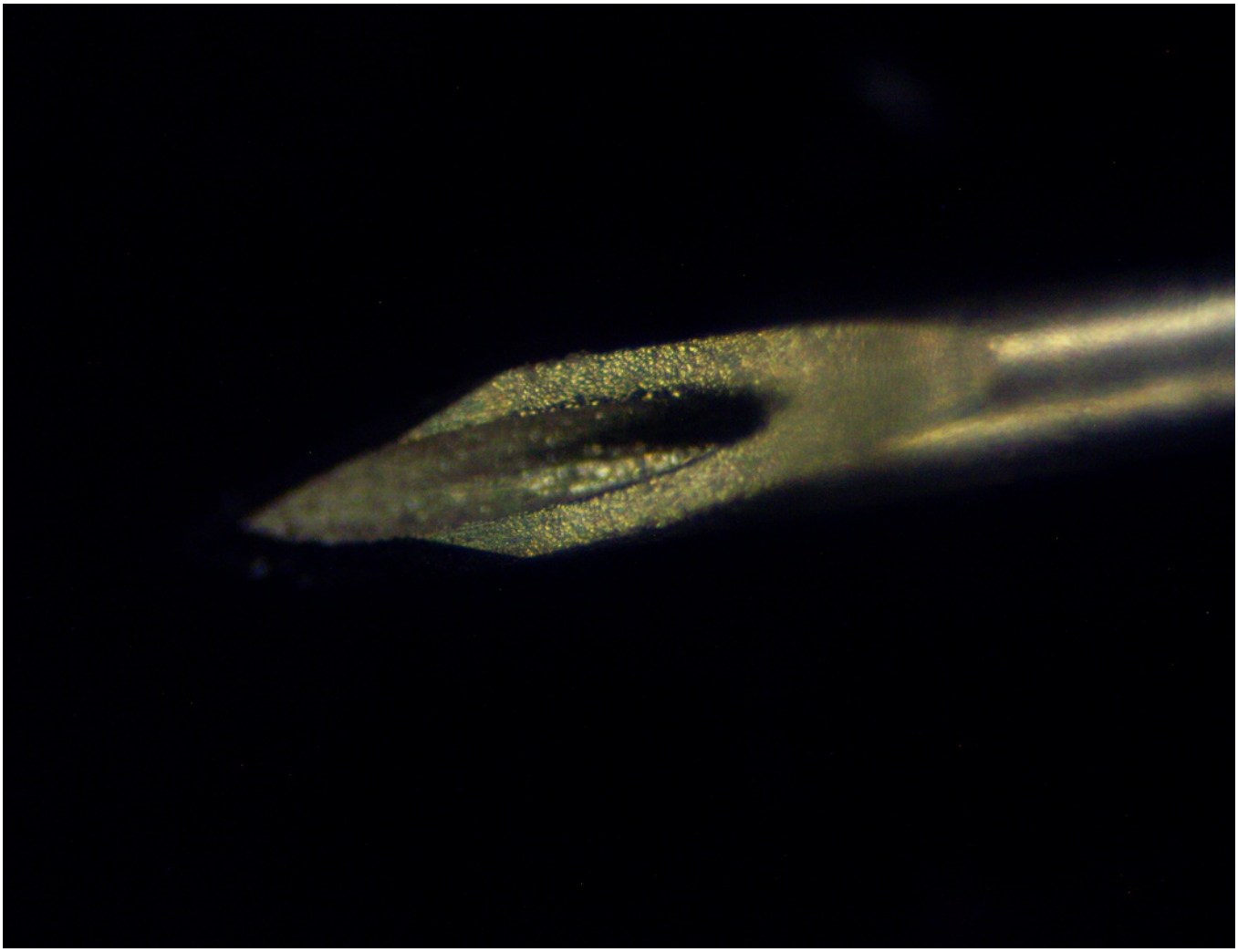
RESULTS:

Part of the center of a Mexican 10 peso coin, with a diameter of 2.5 cm, 4x

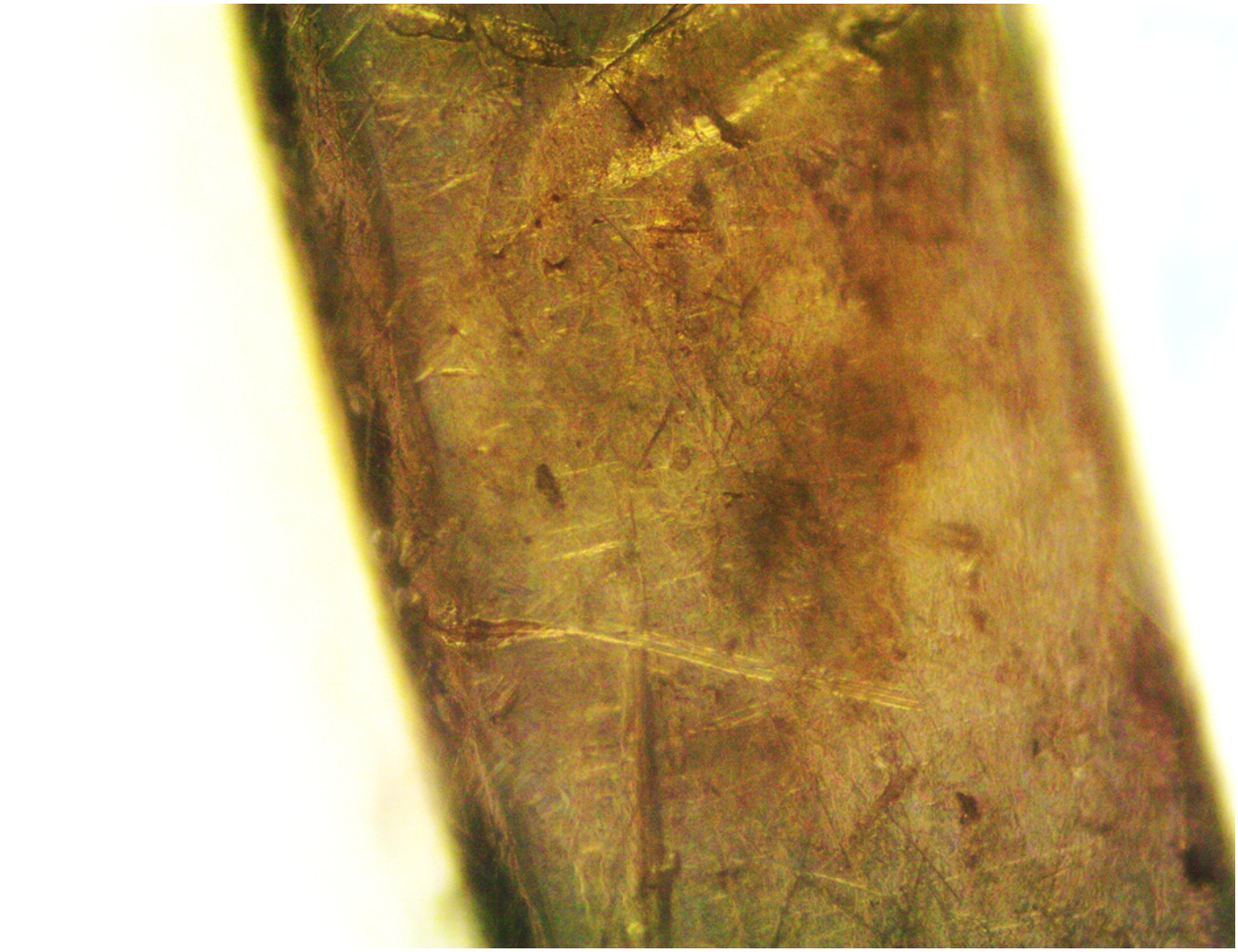
Part of the year of coining of an old Mexican 50 cent coin 4x



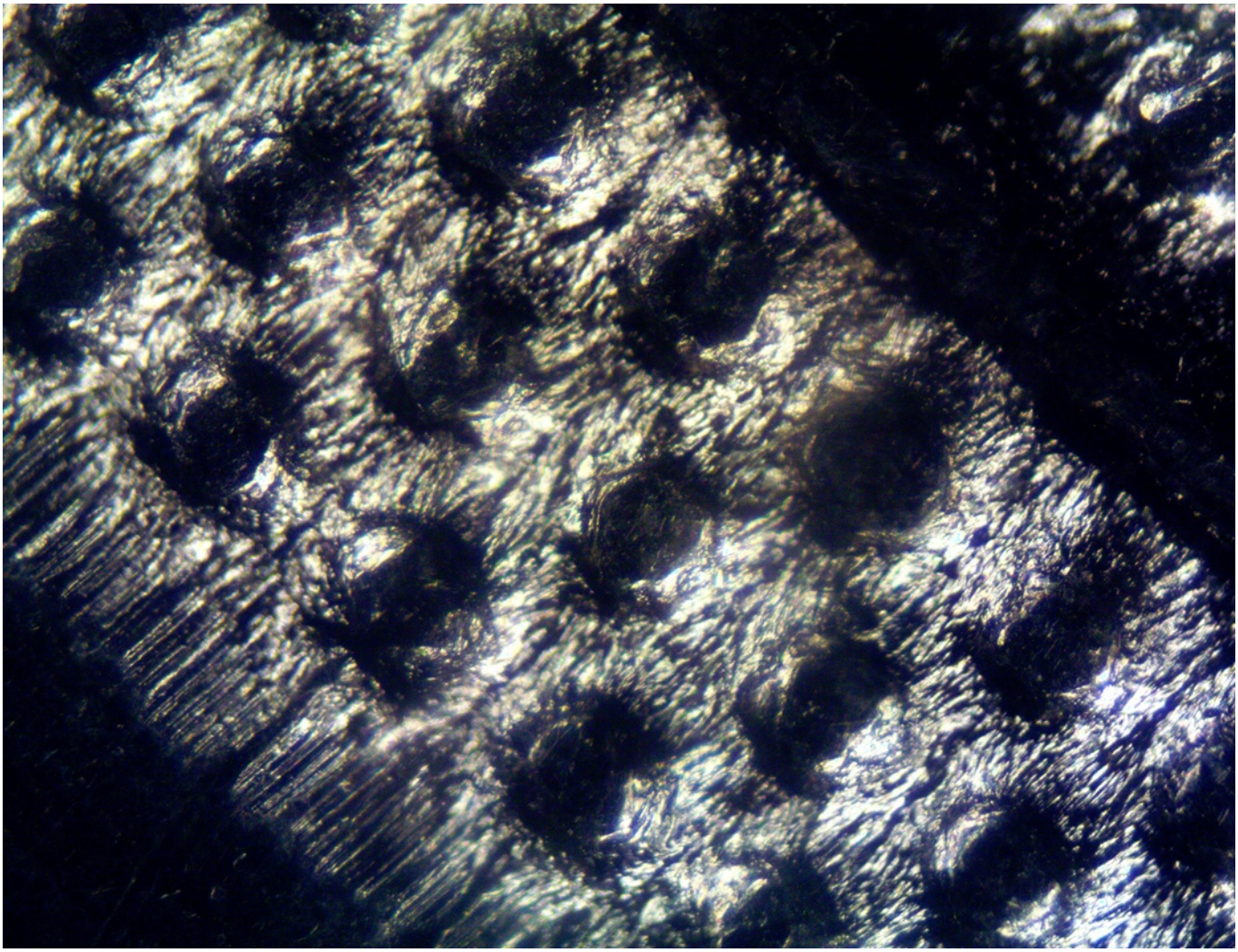
Part of an electronic circuit 4x



Part of a syringe needle for insulin application 4x



Part of a wedding ring 10x



Part of the texture of a lock's key 4x

CONCLUSION:

DIY LIEBERKÜHN MIRRORS are extremely useful for the enthusiast microscopist, because sometimes-buying epi -illumination microscopes is difficult to afford.

They are easy to produce at home with ordinary objects and they may expand the potential observations exponentially.

Remember that any time that we are able to illuminate from above a sample with a useful method we open up a new world to explore.

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Published in the July 2017 issue of *Micscape* magazine.

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