Some Experiments with LED Arrays

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Some time ago I came across a very nice Vickers Instrument badged binocular microscope with a turret of four CTS lenses on a market stall for the princely sum of £30. Its condition was excellent and its price was intended to reflect that the stallholder had lost the lead for the built in light source. This did not seem an insuperable problem so I bought it on the spot.

On the way home my thoughts were that I should put in a 1 watt LED driven by a constant current power supply. When I removed the aluminium base plate I realised that the physical layout meant that this might not be quite so simple as I had assumed.

What to do then? Originally a cone of light from the compact source tungsten bulb had been captured by a convex lens immediately below a piece of frosted glass. Which meant the source seen by the condenser was the upper surface of the frosted glass not the approximately parallel beam emerging from the upper surface of the lens. I judged that all I had to do was flood the lower surface of the frosted glass with light. But I still needed a suitable source.

An evening scanning the WWW turned up a number of candidates all made for use in cars. These had a further advantage that they did not need to be driven by a constant current source. Furthermore they would not be too fussy about the exact voltage because a discharged car battery can have a voltage as low as 10V whilst charging may be done at up to 13V.

In the end I settled on a flat 48 LED Chip On Board (COB) lamp intended for use as a replacement interior bulb. These are about 25mm square and the undersurface has a spongy adhesive layer which was pressed on the aluminium cover plate about 20mm below the lens/ground glass pair. The aluminium cover plate is in contact at the edges with the large mass of the microscope body and acts as an effective heat sink.

During initial testing and before I fitted it to the microscope I tried using a 12V ‘wall wart’ which had originally powered a modem. This worked but I was troubled by a faint glow when only one lead was connected and I was holding the other lead. Clearly the supply was not completely isolated from the mains and there was a small leakage current. I will not be using this sort of supply for similar experiments in the future.

The only fully isolated supplies I have are nominally 13.8V units I use to power my amateur radio equipment which put out 13V. This drops to a to 12.2V with a 1N4000 power diode in series. When a second power diode is switched into circuit the voltage to 11.4V. A plug and socket taken from redundant power supply replaced the originals.

After a minute or so the current drawn by the 48 LEDs stabilises at 120mA when the higher voltage is used and 71mA at the lower voltage. Images which

are comfortably bright at 400x magnification and usable at 1000x. Switching the second diode into circuit dims the image sufficiently to make observing at lower magnifications more comfortable. This is achieved without a shift in colour.

The device used can be found on the e-bay site by searching for *'White 48 SMD COB LED 12V Car Interior Panel Light Dome Lamp Bulb'.* One of these devices can be seen in operation at https://www.youtube.com/watch?v=wPrqxzvDlA8 .

Further searches on the e-bay site turned up a number of devices which with a little effort can be turned into light sources for microscopy.

Initially I used white 12 LED COB 12V indicator lamps for incident illumination of specimens viewed under a stereo microscope. Two of these mounted at 45 degrees to the centre of the stage give bright 'shadowless' illumination. Similar COB devices are available in blue, green, orange and red.

At 12.2V/11.4V these have an input power of 850mW/650mW (white and blue), 790mW/630mW (red) and 670mW/500mW (green). A white 22 LED Surface Mounted (SMD) device has an input power of 610mW/470mW. There is some variation between devices and the values have been rounded.

They are available on the e-bay site as *'1156 BA15S 12 LED COB 12V Car Stop Tail Light Turn Brake Lamp Bulb'.* Specify the colour to help the search. Suitable holders are *'1156 BA15s LED Light Bulb Socket Holder With Wire Connector'.*

The blue produces fluorescence from some kinds of ink. Excellent barrier filters can be found in discarded older type digital projectors. Pairing the green and red devices enables surface detail to be detected on an otherwise 'flat' surface and gives interesting effects when examining rocks. They also make excellent monochromatic light sources for use with my Beck 47 microscope.

I suspect that the devices which find their way onto the e-bay site are 'out of spec' which accounts for their low prices. Experience suggests that any power rating specified should be divided by 3 or 4. Nonetheless they are good value for money and cheap enough to experiment with.

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