

BEL AIR MASS FINISHING MQP

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OBJECTIVE

- Study surfaces produced by mass finishing
- Understand the basic mechanisms we have determined the normal forces between a surface and a sample mass finishing media
- Study how the surface produced by mass finishing effects the shininess of the surface.

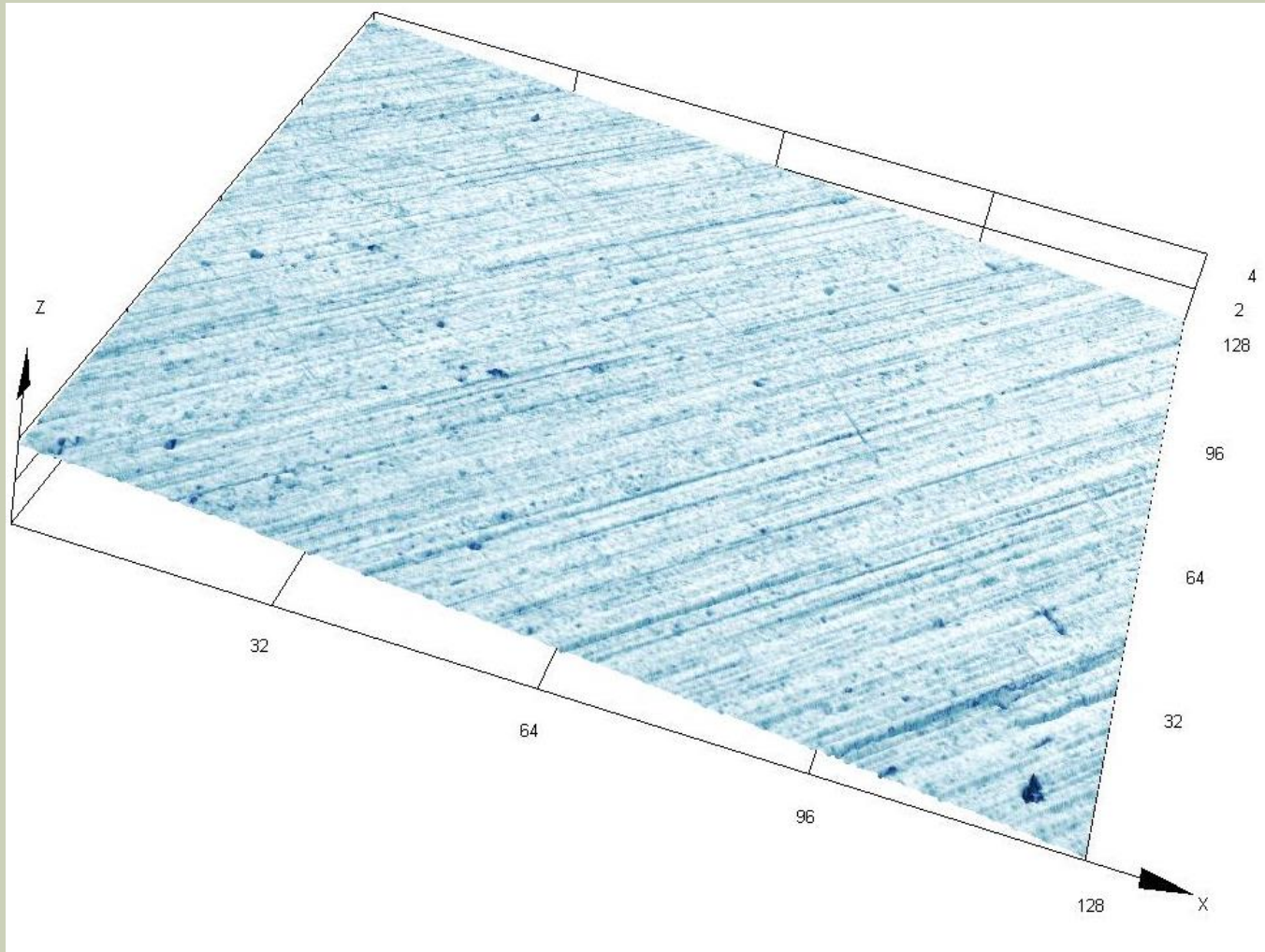
BEL AIR FMSL 22 CENTRIFUGAL DISC FINISHER



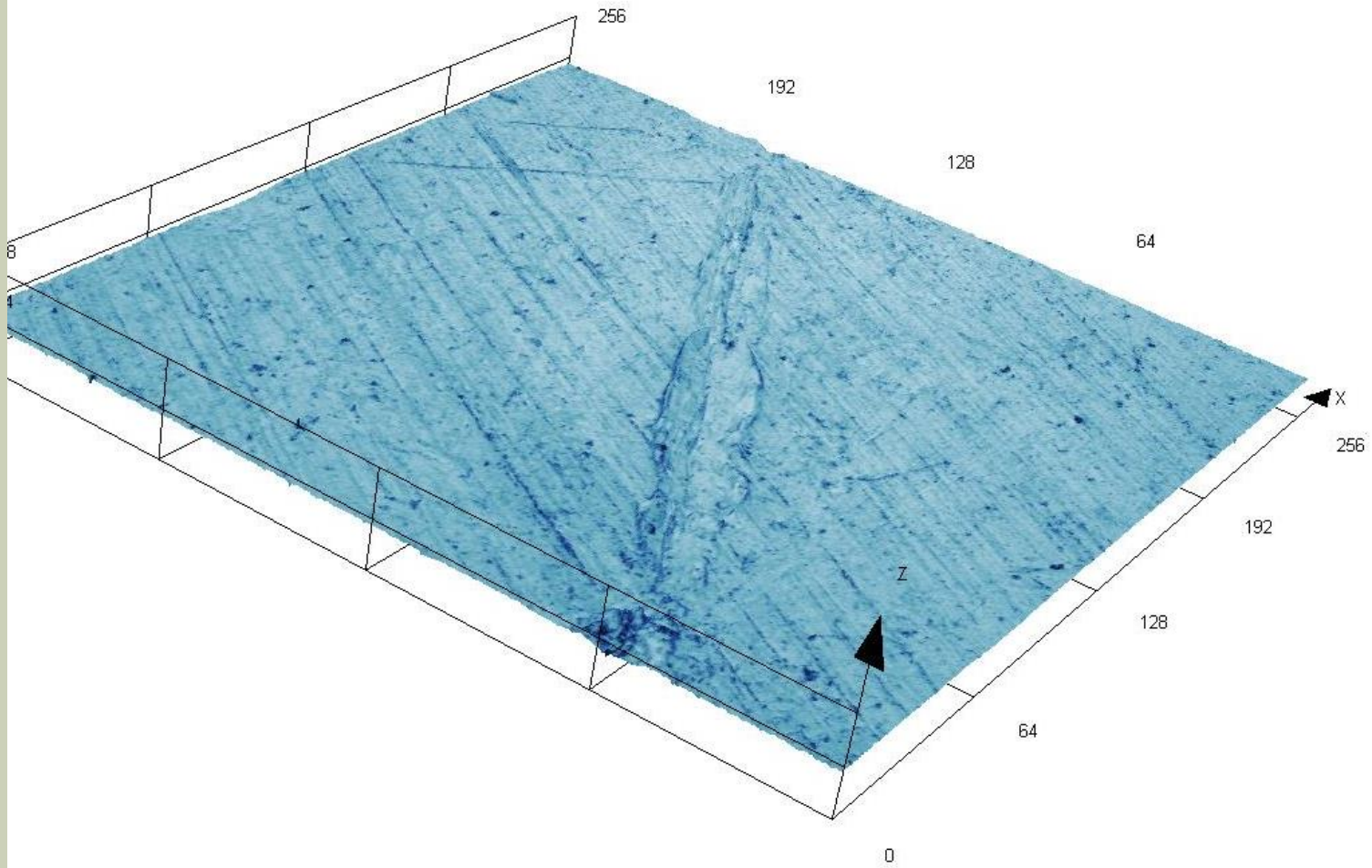
EXPERIMENT, SCRATCH DEPTHS

- Al 6061-T6
- Polished Al Surfaces to a mirror.
- Obtained a Vickers Hardness value of the surface
- Mass Finished with abrasive media for 30 s.
- Measured the depths of the scratches
- Calculated the normal force

POLISHED SURFACE (100X)



EXAMPLE SCRATCH (50X)



EQUATION USED FOR FORCE CALC

$$HV = \frac{F}{A} \approx \frac{0.1891F}{d^2}$$

HV= Vickers Hardness

F= Force (Newtons)

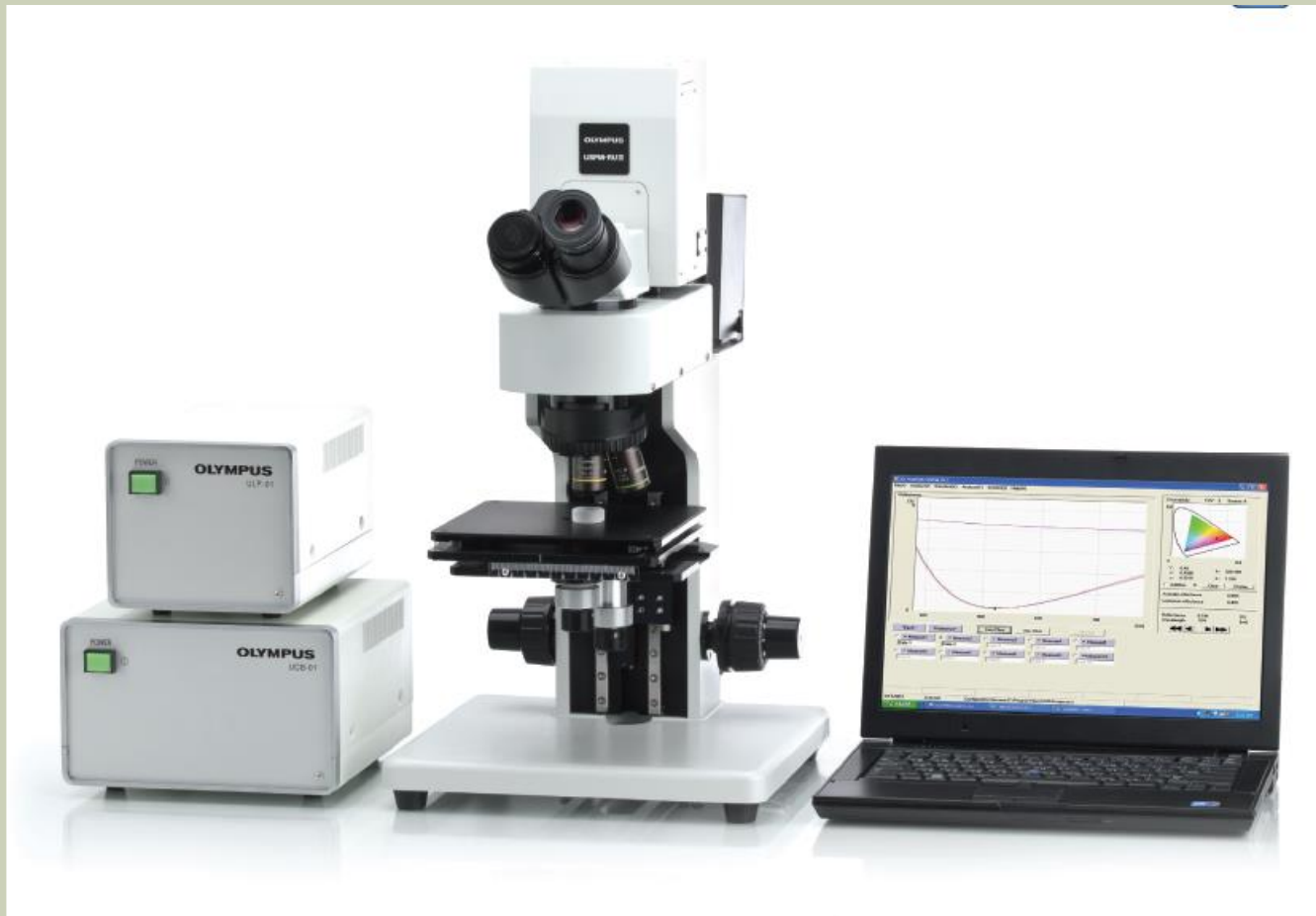
A= Area

RESULTS

Parameter	Mean Value	Standard Deviation
Scratch Depth	0.399 μm	0.180 μm
Scratch Width	5.396 μm	1.337 μm
Scratch Cross-Sectional Area	2.204 μm^2	0.790 μm^2
Vickers Hardness	124.0 $\text{HV}_{10\text{g}}$	6.555 $\text{HV}_{10\text{g}}$
Normal Force	19.09 mN	-

Normal Force = 0.07 ounces

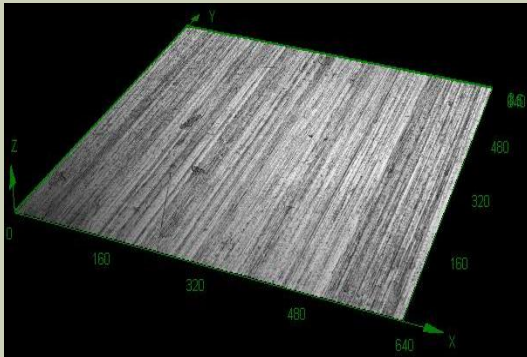
OLYMPUS USPM-RU III MICRO SPECTROPHOTOMETER



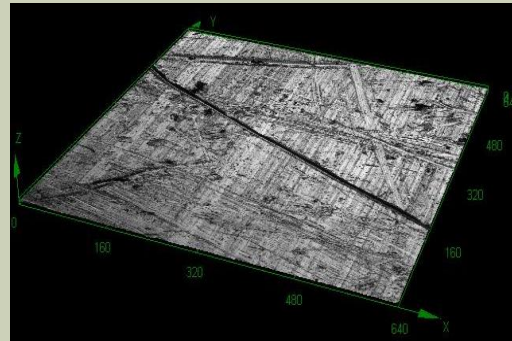
EXPERIMENT, REFLECTIVITY

- Turned Al 6061-T6 @ 0.05mm/rev @ 2000 rpm (~3.94 in/min)
- Took measurements of surface on confocal microscope
- Mass Finished for 30s, 1 min, 4min, 10 min, 30 min, & 60 min taking measurements of the surface at each time interval
- Also, measurements were taken with the spectrophotometer

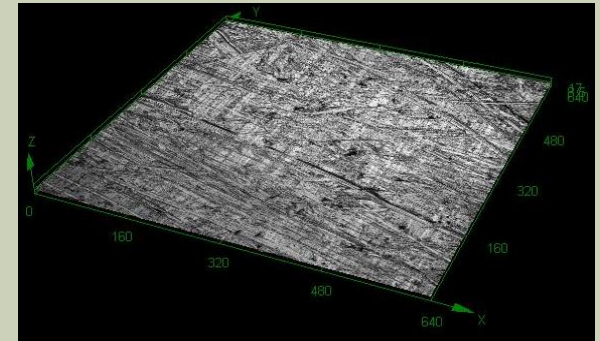
IMAGES OF SURFACES (20X)



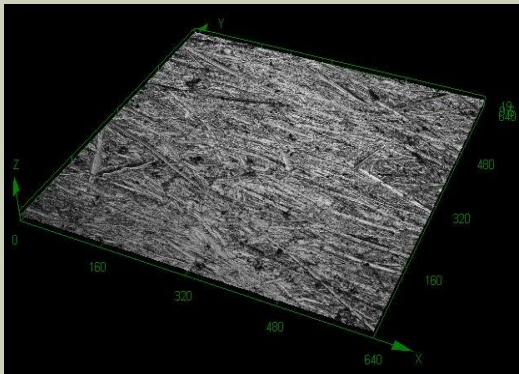
Initial



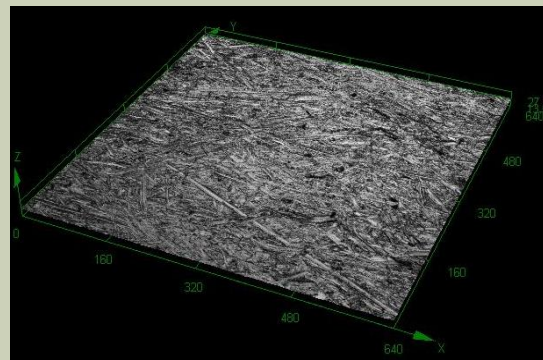
30s



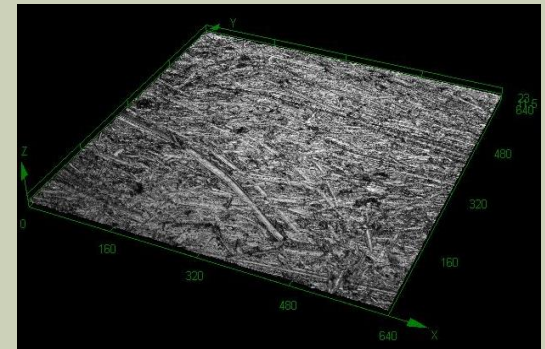
1 min



4 min



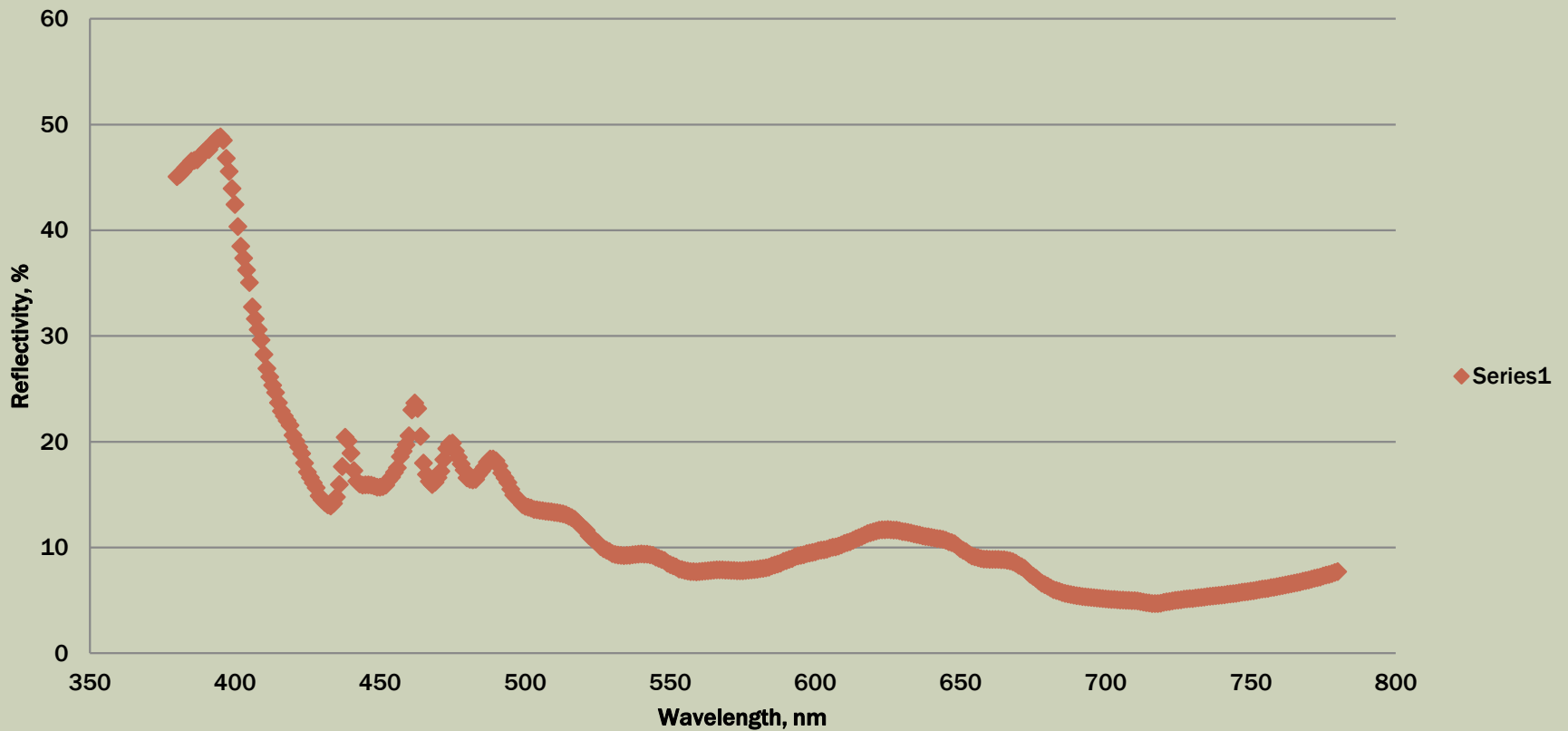
10 min



1 hr.

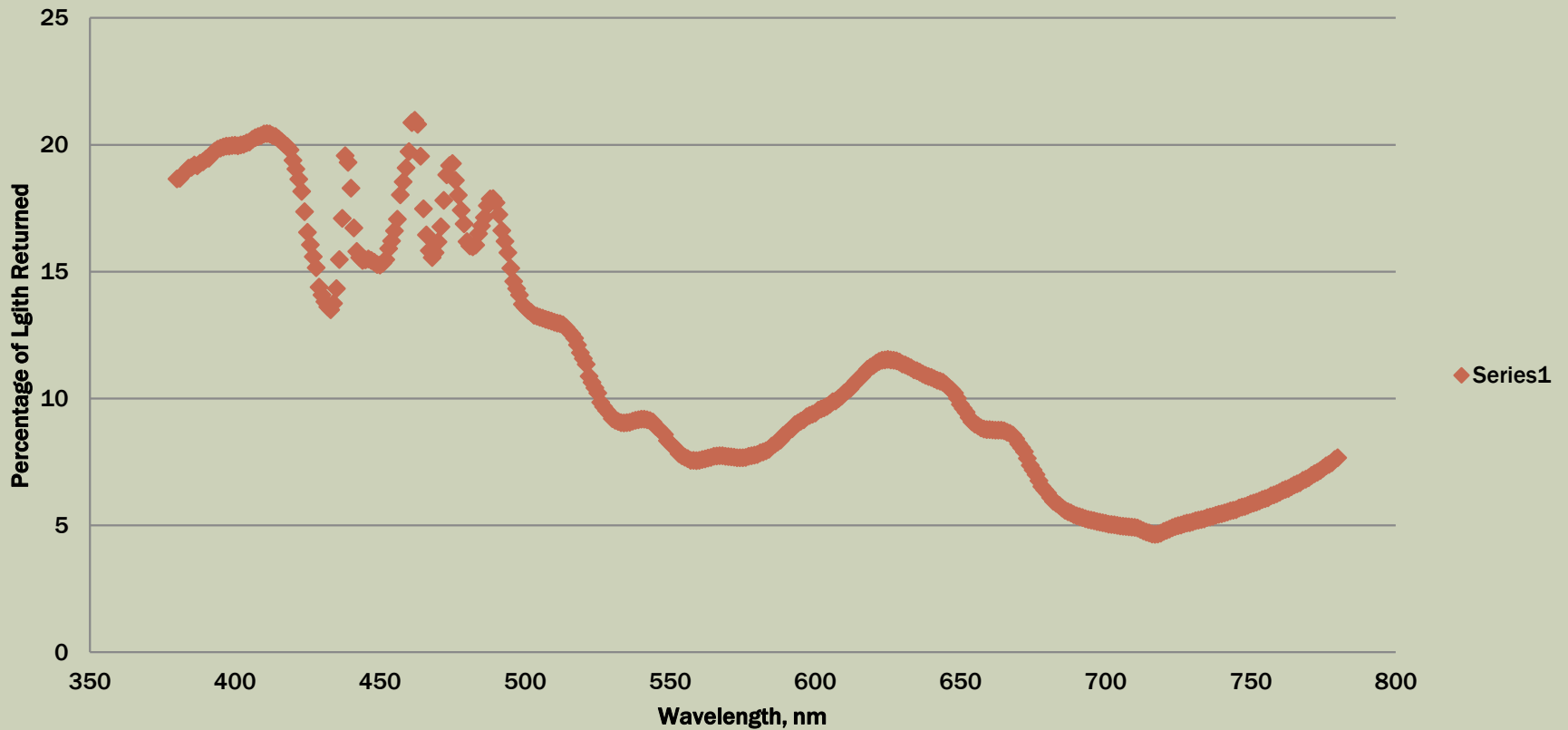
SPECTROPHOTOMETER RESULTS (INITIAL)

Percentage of Light Returned vs. Wavelength



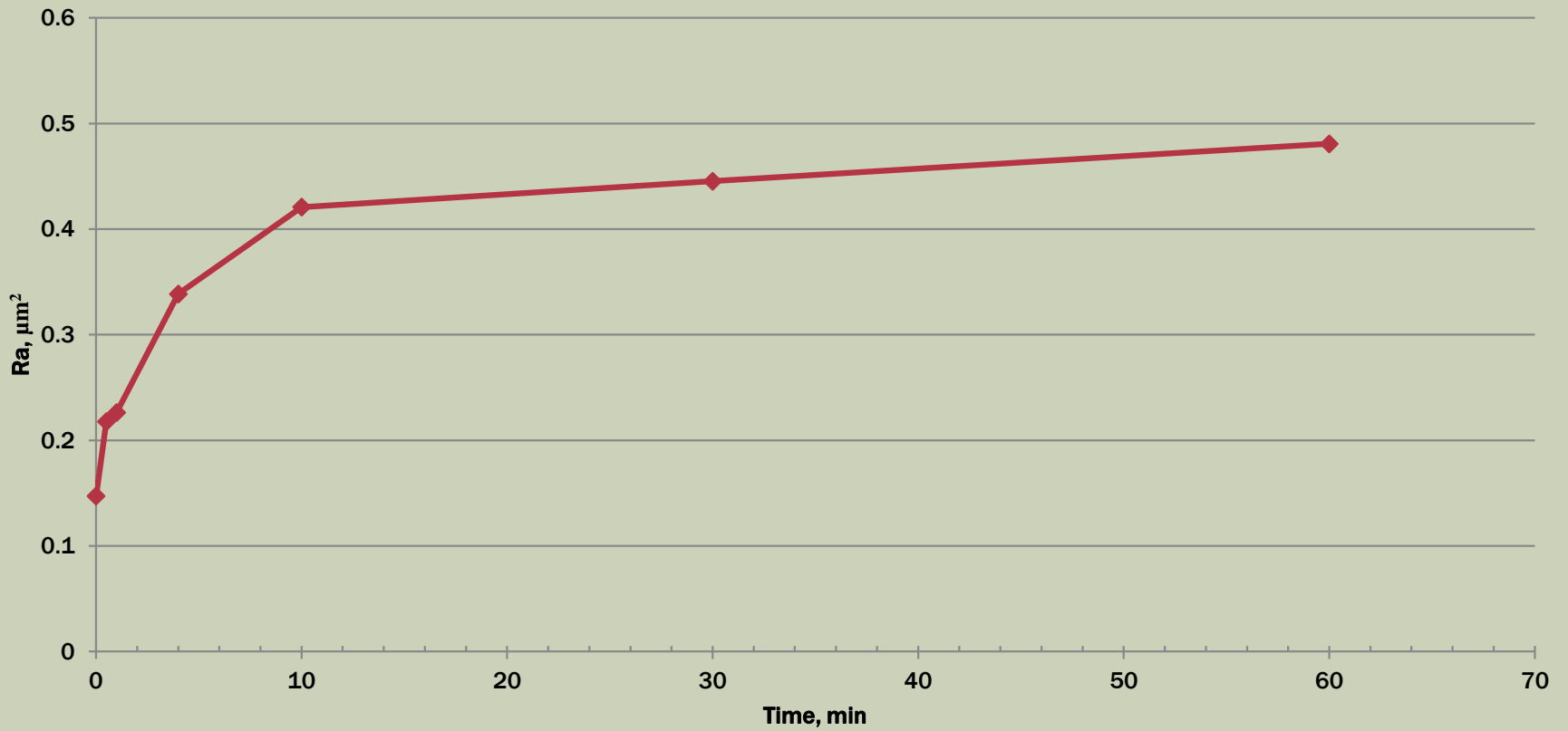
SPECTROPHOTOMETER RESULTS (1 HR)

Percentage of Light Returned vs. Wavelength

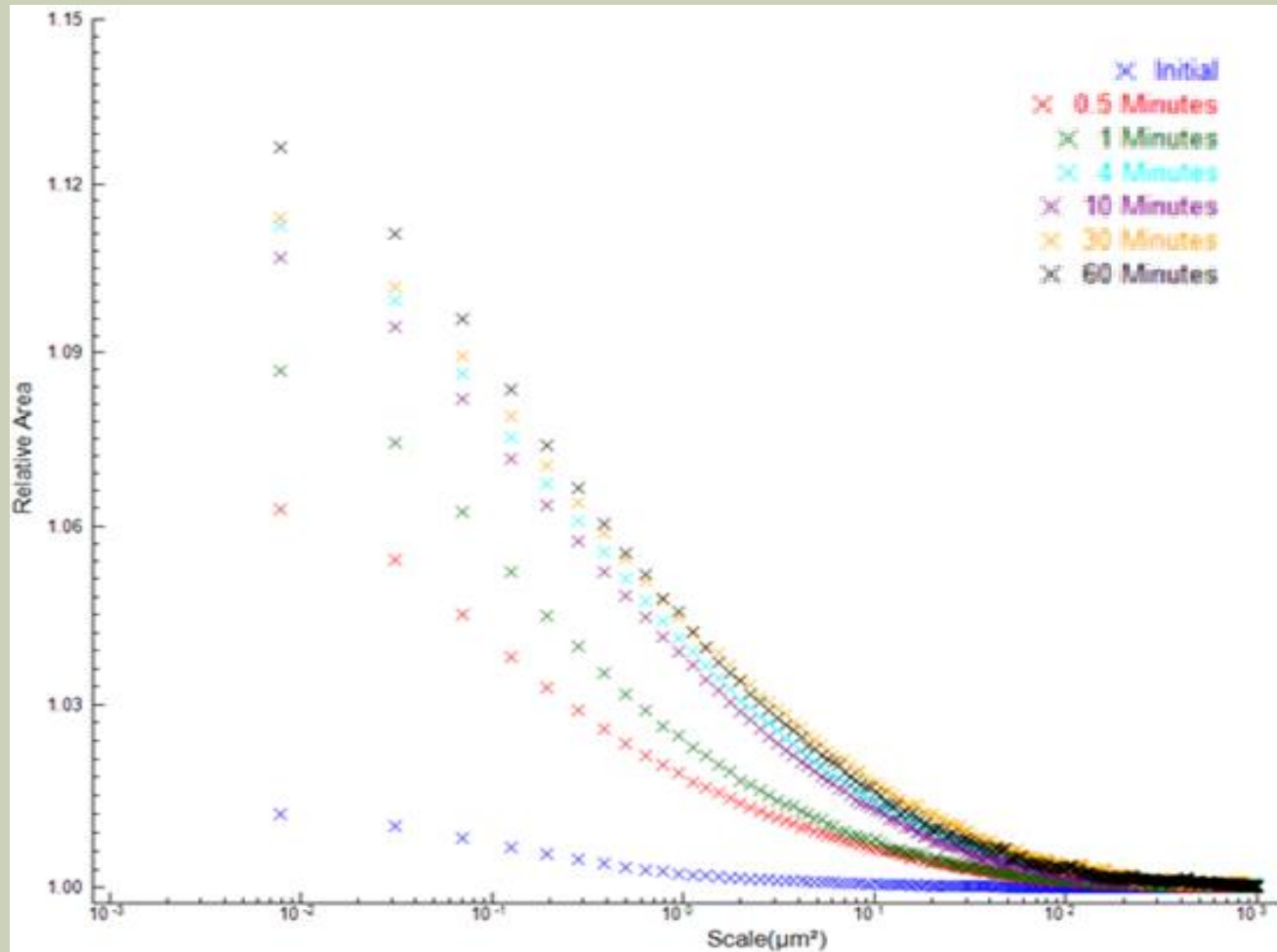


ROUGHNESS VS. TIME

Roughness vs. Time in Finisher

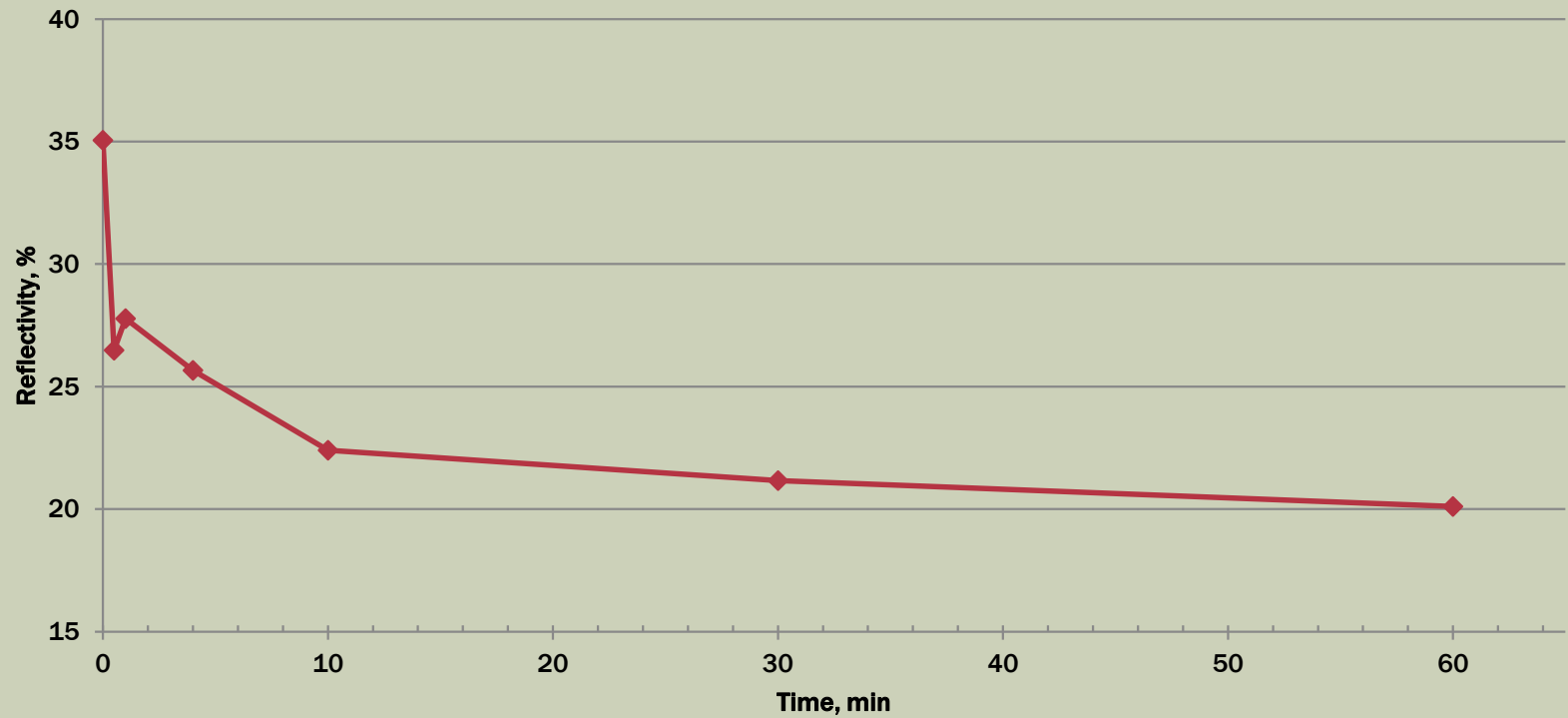


RELATIVE AREA VS. SCALE FOR ALL TIMES 100X OBJECTIVE



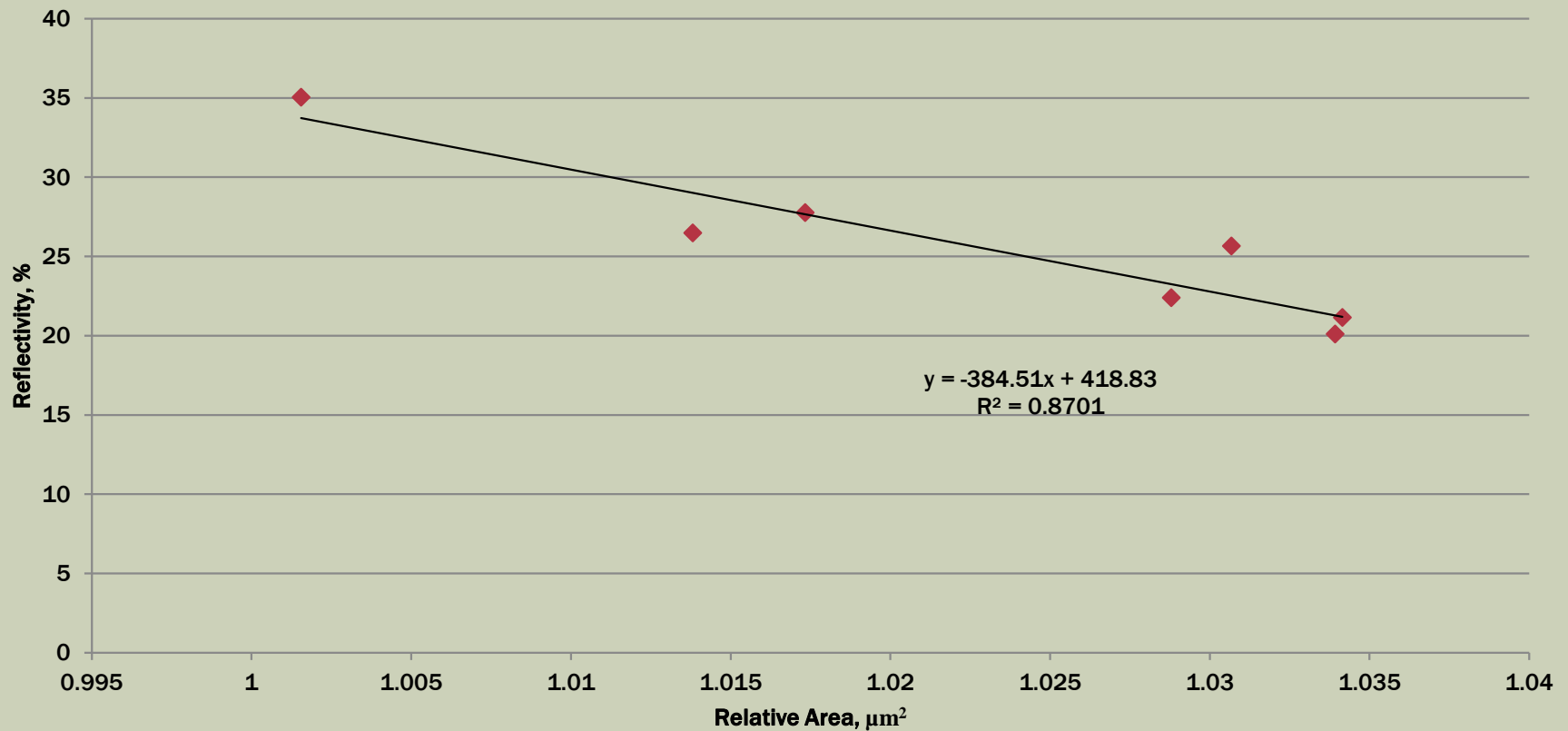
REFLECTIVITY VS. TIME

Reflectivity (405 nm) vs. Time



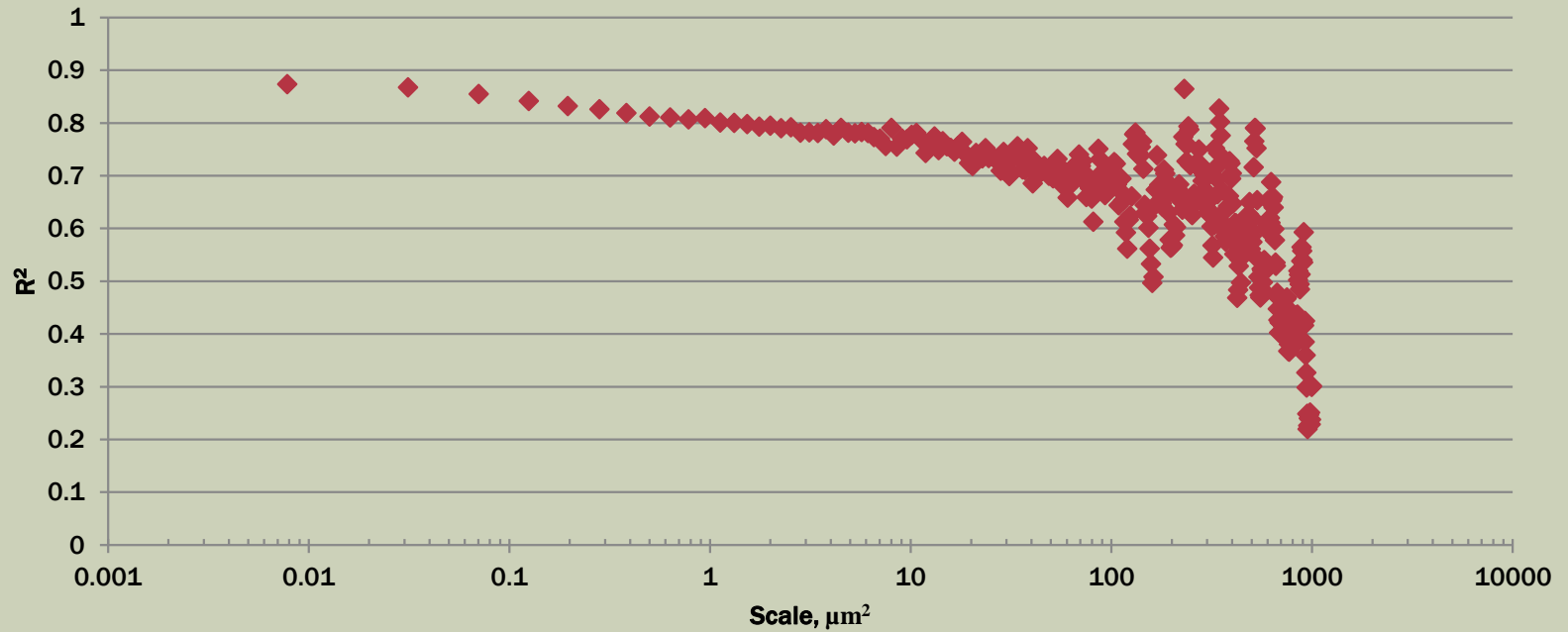
RELATIVE AREA VS. REFLECTIVITY

Relative Area ($2 \mu\text{m}^2$) vs. Reflectivity (405 nm)

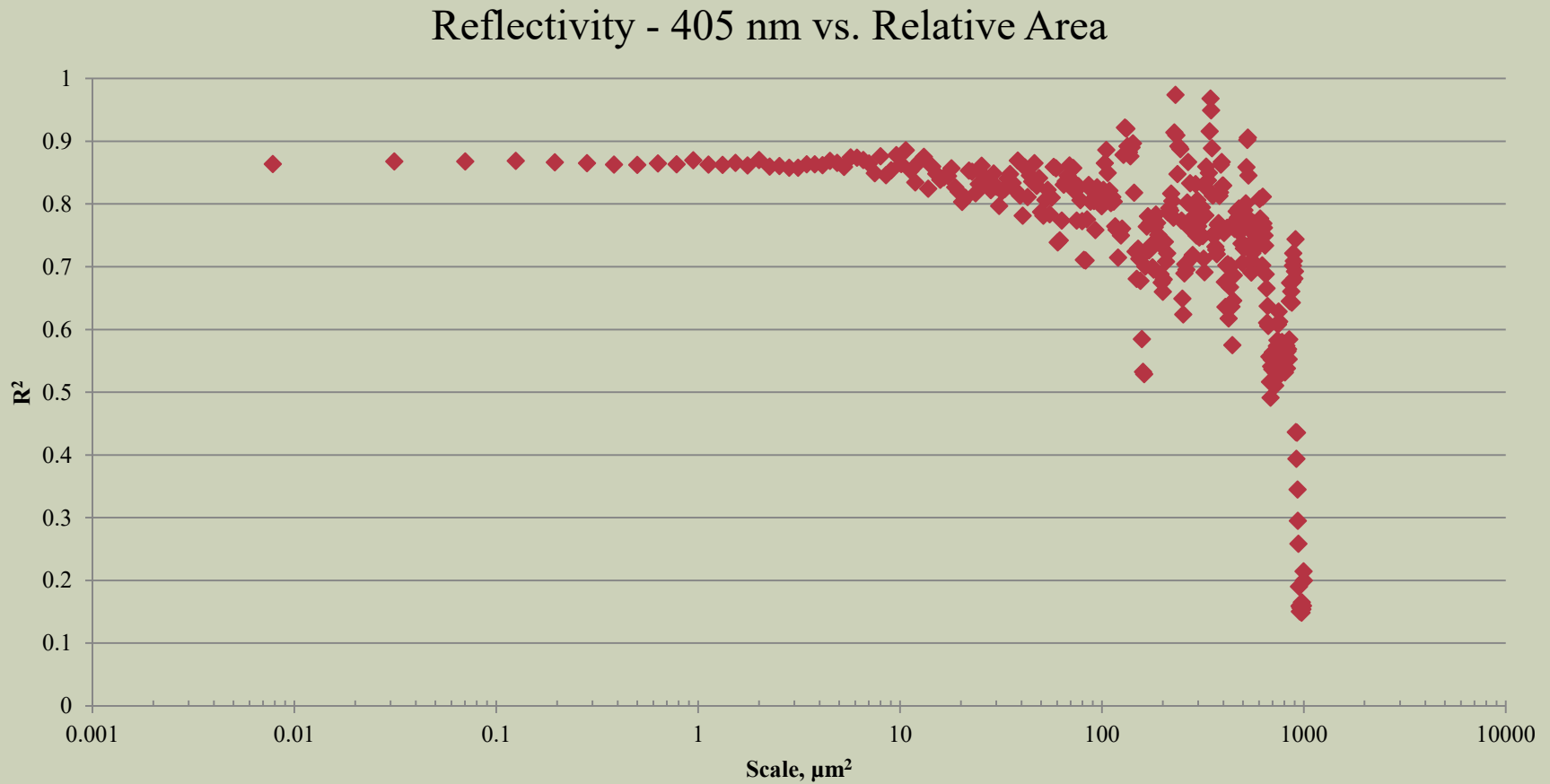


CORRELATION OF REFLECTIVITY AND AREA SCALE (380NM)

Reflectivity - 380 nm vs. Relative Area

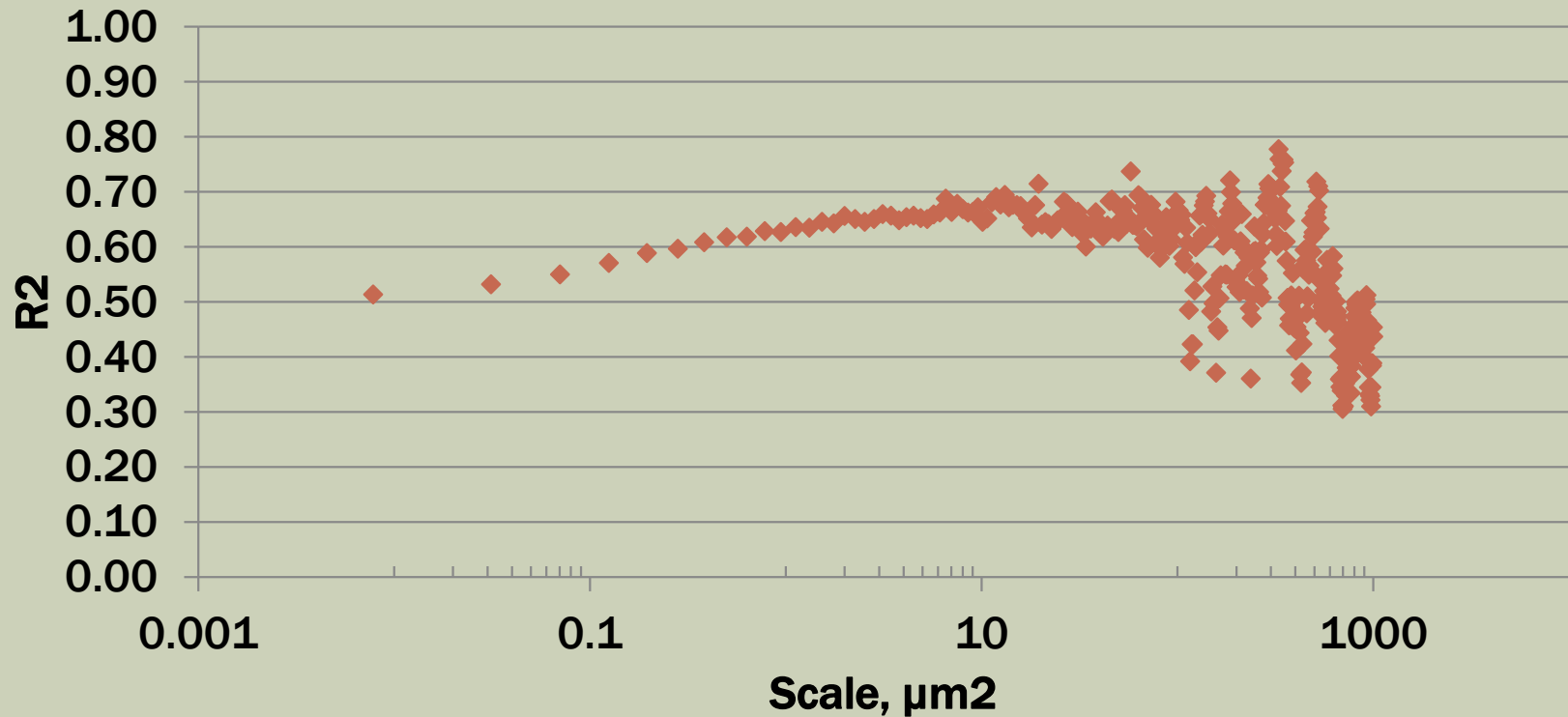


CORRELATION OF REFLECTIVITY AND AREA SCALE (405 NM)

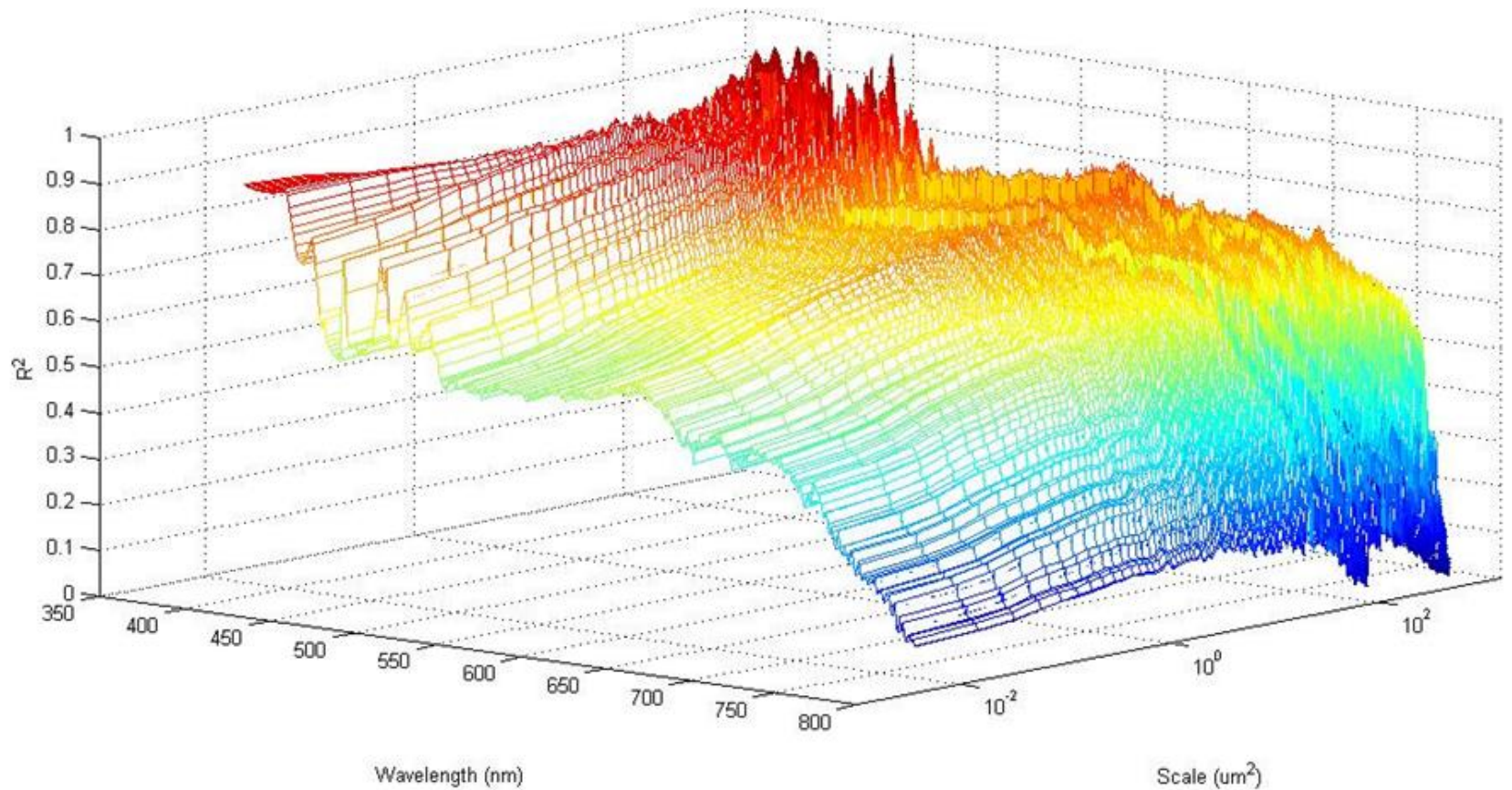


CORRELATION OF REFLECTIVITY AND AREA SCALE (515 NM)

Reflectivity - 515 nm vs. Relative Area



3D GRAPH OF AREA SCALE, WAVELENGTH, AND CORRELATION



RESULTS

- Best correlations found at 405 nm and a scale of $\sim 2\mu\text{m}^2$
- This Wavelength of light is the same used in the confocal microscope's laser
 - Unsure of significance of this finding
- Correlations drop off significantly after ~ 450 nm and again at ~ 600 nm