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Atomic Force Microscope (AFM) measurements and analysis on Sagem 05R0025 secondary substrate

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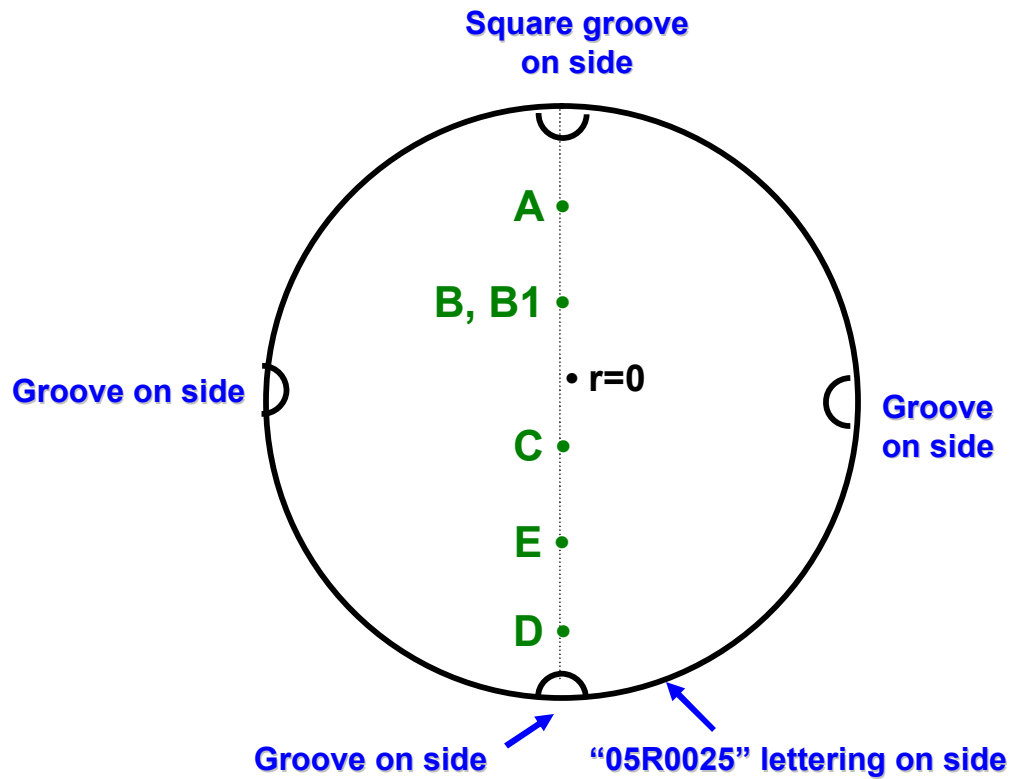
Atomic Force Microscope (AFM) measurements and analysis on Sagem 05R0025 secondary substrate

**Regina Soufli, Sherry Baker, and Jeff C. Robinson
January 17, 2006**

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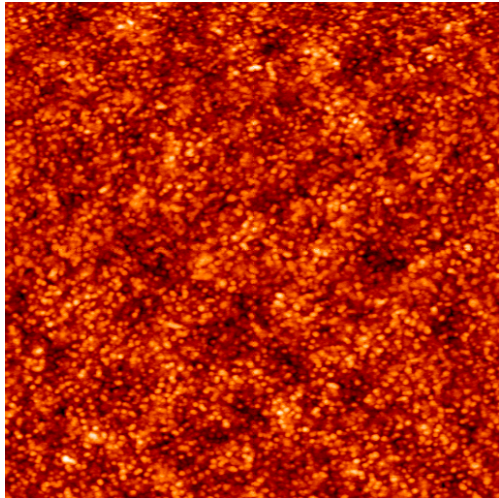
Map of AFM measurement locations on Sagem 05R0025 secondary



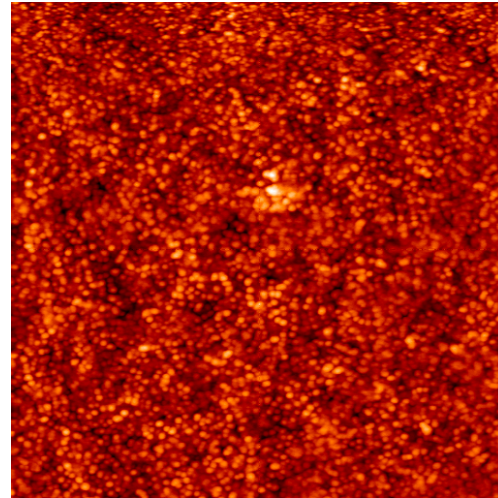
Location	Radius r from mirror center (mm)
A	25
B	18
C	13
D	32
E	22



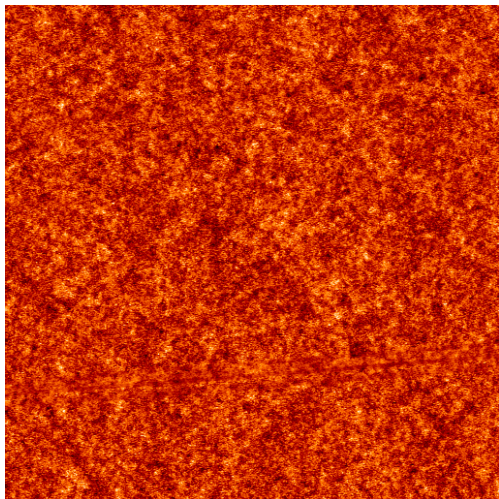
AFM images from Sagem 05R0025 secondary



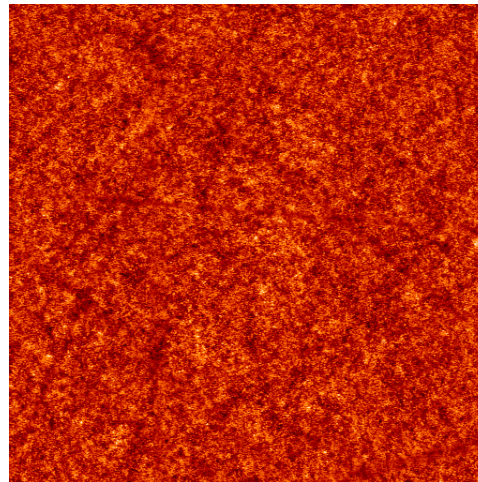
2x2 μm^2 , loc. A



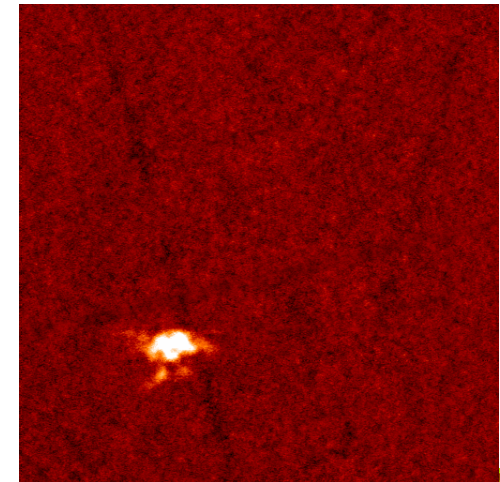
2x2 μm^2 , loc. B



10x10 μm^2 , loc. A



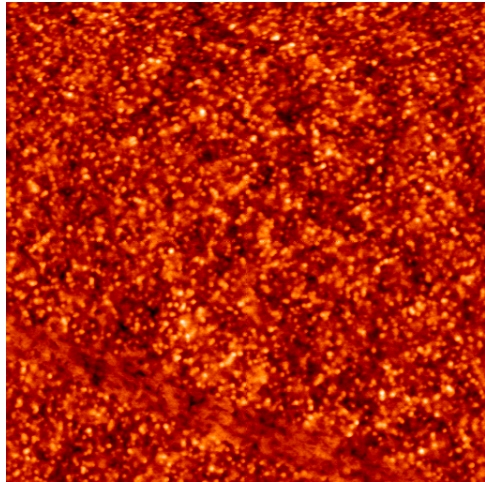
10x10 μm^2 , loc. B



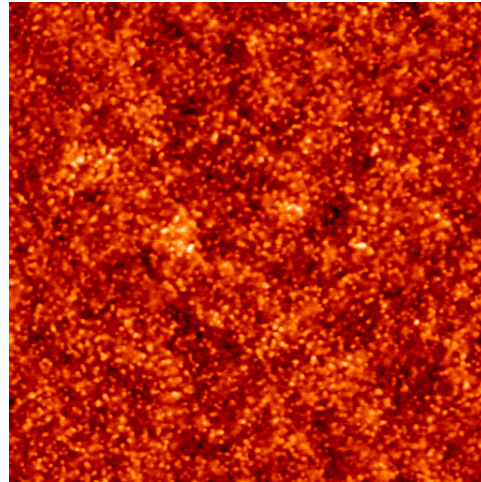
10x10 μm^2 , loc. B1



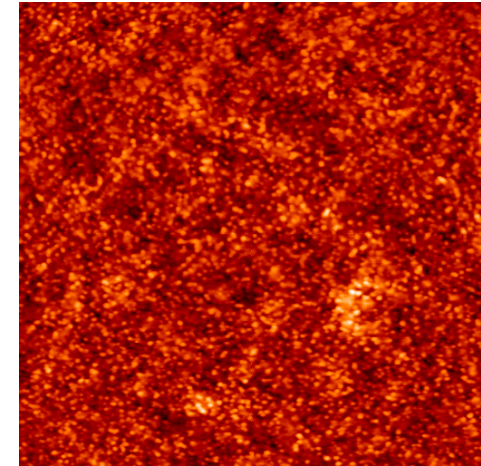
AFM images from Sagem 05R0025 secondary



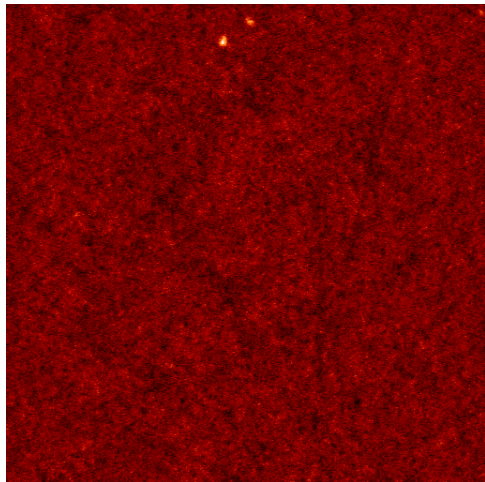
2x2 μm^2 , loc. C



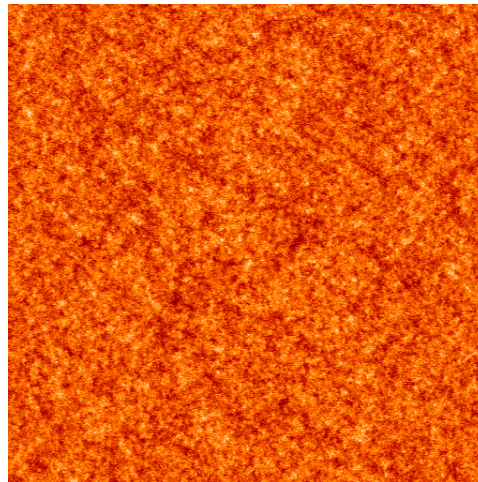
2x2 μm^2 , loc. D



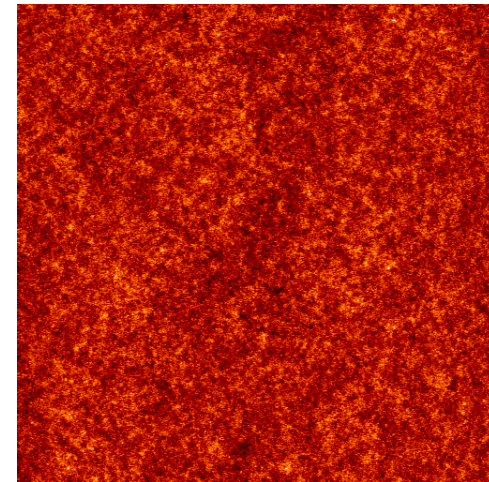
2x2 μm^2 , loc. E



10x10 μm^2 , loc. C



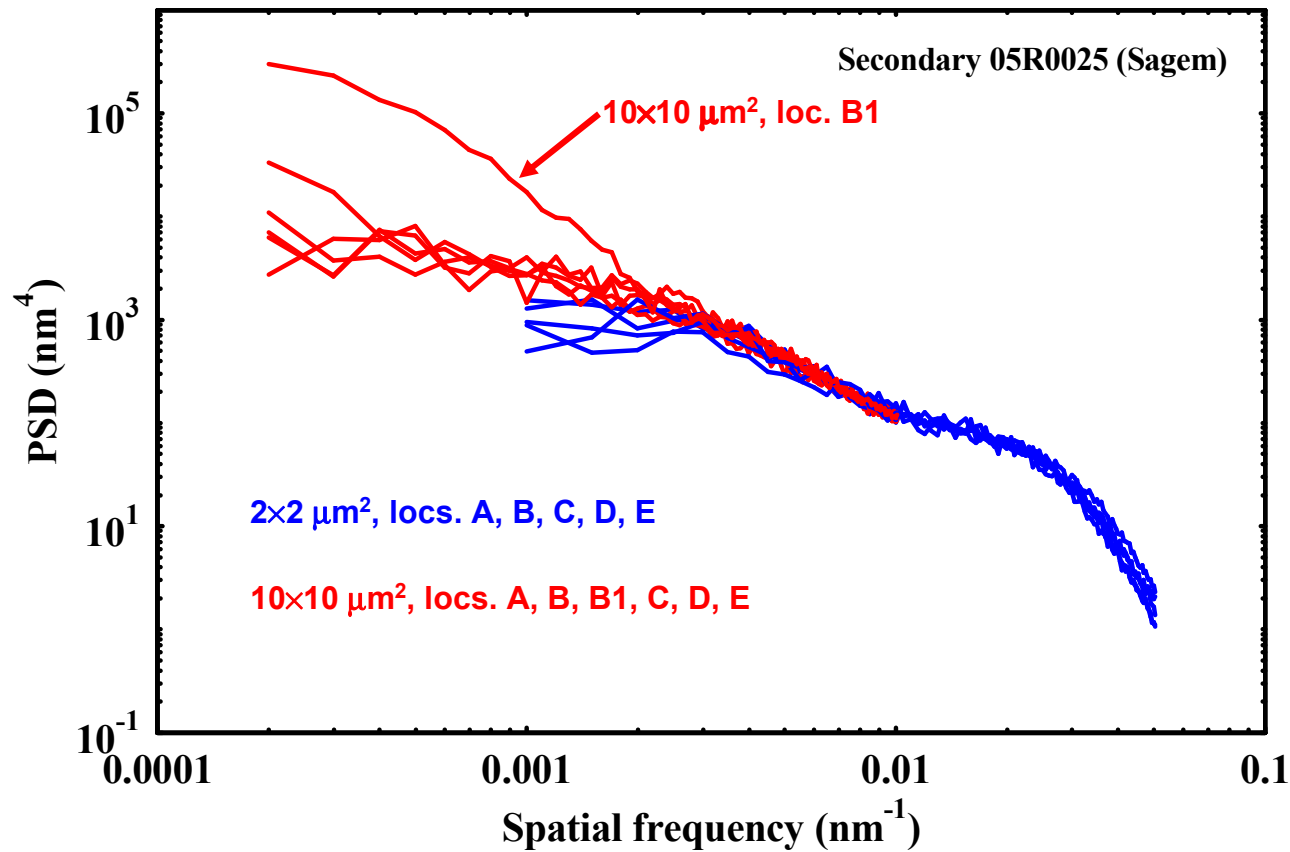
10x10 μm^2 , loc. D



10x10 μm^2 , loc. E



Power Spectral Density (PSD) analysis of AFM data from Sagem 05R0025 secondary substrate



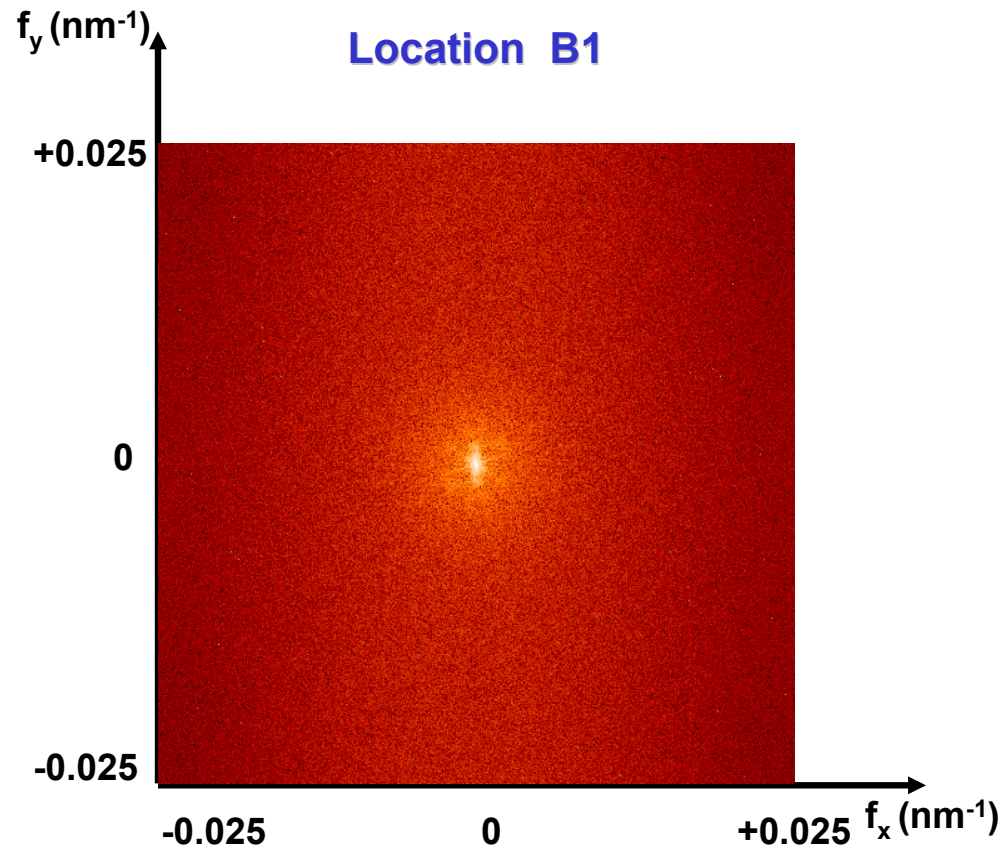
Location	σ (nm)
A	0.55
B	0.54
C	0.51
D	0.54
E	0.54

$$\sigma^2 = \int_{f_1}^{f_2} 2\pi f S(f) df \quad \text{where } S(f) \equiv \text{PSD (nm}^4\text{),}$$

$$f_1 = 10^{-3} \text{ nm}^{-1}, f_2 = 5 \times 10^{-2} \text{ nm}^{-1}$$



2D PSD image vs. spatial frequency of 10×10 μm² AFM scan from Sagem 05R0025 secondary substrate



Summary of AFM on Sagem 05R0025 secondary substrate

- **2×2 μm² and 10×10 μm² AFM measurements and analysis on Sagem 05R0025 secondary substrate at LLNL indicate rather uniform and extremely isotropic finish across the surface, with high-spatial frequency roughness σ in the range 5.1 – 5.5 Å rms**
- **The marked absence of pronounced long-range polishing marks in any direction, combined with increased roughness in the very high spatial frequencies, are consistent with ion-beam polishing treatment on the surface. These observations are consistent with all earlier mirrors we measured from the same vendor.**
- **All data were obtained with a Digital Instruments Dimension 5000™ atomic force microscope**
- **Special thanks to D.L. Windt for crucial updates to the TOPO software for AFM data analysis**

