

## MoRu/Be: a newly developed beryllium-based multilayer

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We present a new beryllium-based multilayer system that has been developed for extreme ultraviolet lithography (EUVL) optics. This multilayer pair consists of polycrystalline Be and an amorphous MoRu alloy. The multilayer exhibits many properties that make it very desirable for EUVL: reflectivity as high as 69.3% at a wavelength of 11.4 nm (achieved with 50 bilayers giving a bandwidth of 0.35 nm), near-zero intrinsic stress, excellent smoothing properties and time stability. MoRu/Be mirrors can also operate at wavelengths longer than 11.4 nm. For instance, MoRu/Be multilayers have been fabricated to reflect at 13.4 nm with reflectivities of up to 63.9%. Such characteristics make MoRu/Be superior to any other beryllium-based multilayer pair studied to date.

As compared with Mo/Si multilayers at 13.4 nm, the shorter wavelength of 11.4 nm is better matched to the spectral output of gas-jet laser-produced plasma sources, allowing a much higher optical throughput of the lithography tool. The low stress eliminates the risk of deforming precision optics. These characteristics make MoRu/Be multilayers a very attractive candidate for EUV lithography.

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