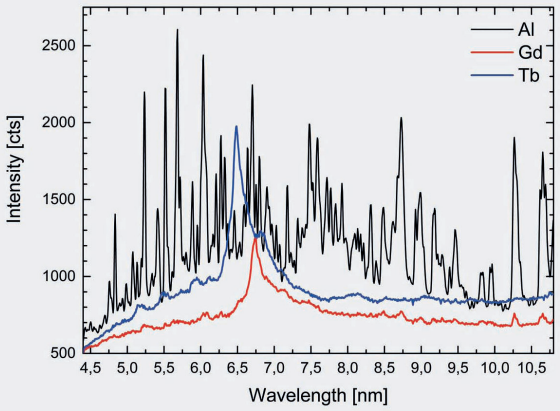

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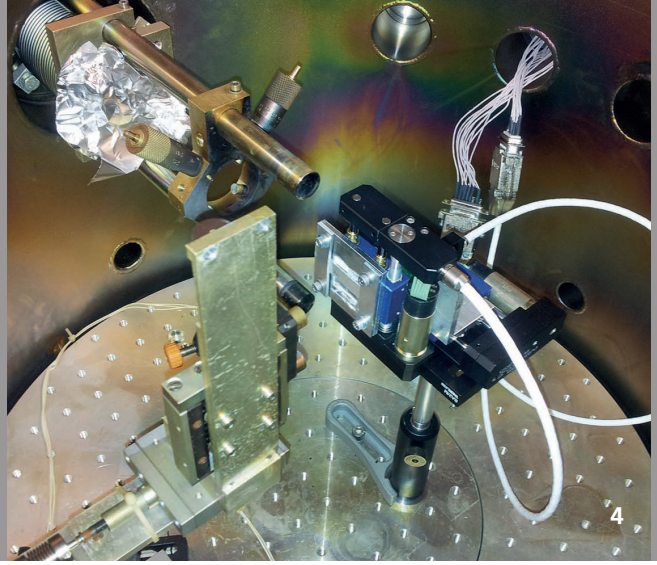

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ALTERNATIVE EMITTER FOR EFFICIENT RADIATION SOURCES AT 6.7 NM

Task

Dense, hot plasmas emitting at 6.7 nm are commonly discussed as radiation sources for the next generation of semiconductor lithography, both in metrology and as a production source. The favorite target materials are currently gadolinium (Gd) or terbium (Tb), which, as an isoelectronic continuation of tin – used for 13.5 nm lithography – have similar emission characteristics with a variety of emission lines. Both elements have to be used as regenerative targets in the liquid state in a commercially usable radiation source. Here, the high melting point and the associated problem of handling these elements in liquid form, however, may prove to be technologically and economically unsuitable.

As alternatives, the elements aluminum (Al) and magnesium (Mg) have been investigated in this project. These elements have intensive line transitions in the spectral region of interest and are attractive because of their lower melting point.

Method

In this project, the emission of laser-produced plasmas (LPP) of Al and Mg has been compared quantitatively with Gd and Tb. Furthermore, low melting Gd/Tb-containing alloys were considered in order to have an alternative regenerative target.

Result

In initial experiments, radiation at 6.7 nm with Al and Mg as emitters was detected, whereby the emission is in the same order of magnitude in direct comparison with Gd and Tb for the same experimental parameters. A study of low-melting alloys yielded promising systems having melting points below 500 °C and based on Al or Mg.

Applications

The radiation sources based on the low-melting Mg or Al alloys are of particular interest for future metrology sources emitting at 6.7 nm.

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3 Al, Gd and Tb-LPP spectra and reflection curve 6.x mirror.

4 Vacuum chamber with sample holder.