# Mueller matrix for Chromium nanofilms on a glass substrate

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The Mueller matrix elements for the set of chromium nanofilms are calculated based on the ellipsometry of the incident and reflected light beams at the four initial polarization states.

## METHODS

The Mueller ellipsometer (see FIG. 1) was used to construct the Mueller matrix (M). The Mueller matrix allows to find the state of the light beam after the reflection, $S_{out}$ from the given surface, knowing the initial state $S_{in}$ of the light beam (see, for example, [1]). The light beam was generated by a He-Ne laser (at about 633 nm wavelength). The nanofilms are opaque for the used laser beam with the power of 15 mW. The age of the samples is about one year. The set of chromium nanofilms, with the layer thickness from 130 nm to 190 nm, was deposited by the method of a thermal sputtering on glass plates.

FIG. 1. The scheme of Mueller polarimeter with the source of light S, polarization generator PG, phase plate PP, linear polarizer P, photodetector PD.
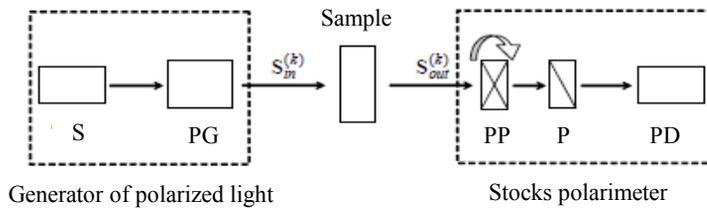


## RESULTS

The normalized elements of the Mueller matrix as the functions of the angle of incidence at the film are depicted in FIG. 2.

FIG. 2. (A), (B), (C, (D). The normalized elements of the Mueller matrix as the function of the angle of incidence at the chromium nanofilm. The films were sputtered during the time interval 5, 6, and 7 minutes, corresponding to the estimated thickness of 132 nm, 151 nm, and 183 nm. Curves for 132 nm (5 minutes sputtering), 151 nm (6 minutes sputtering), and 183 nm (7 minutes sputtering) thick samples are indistinguishable at such resolution.
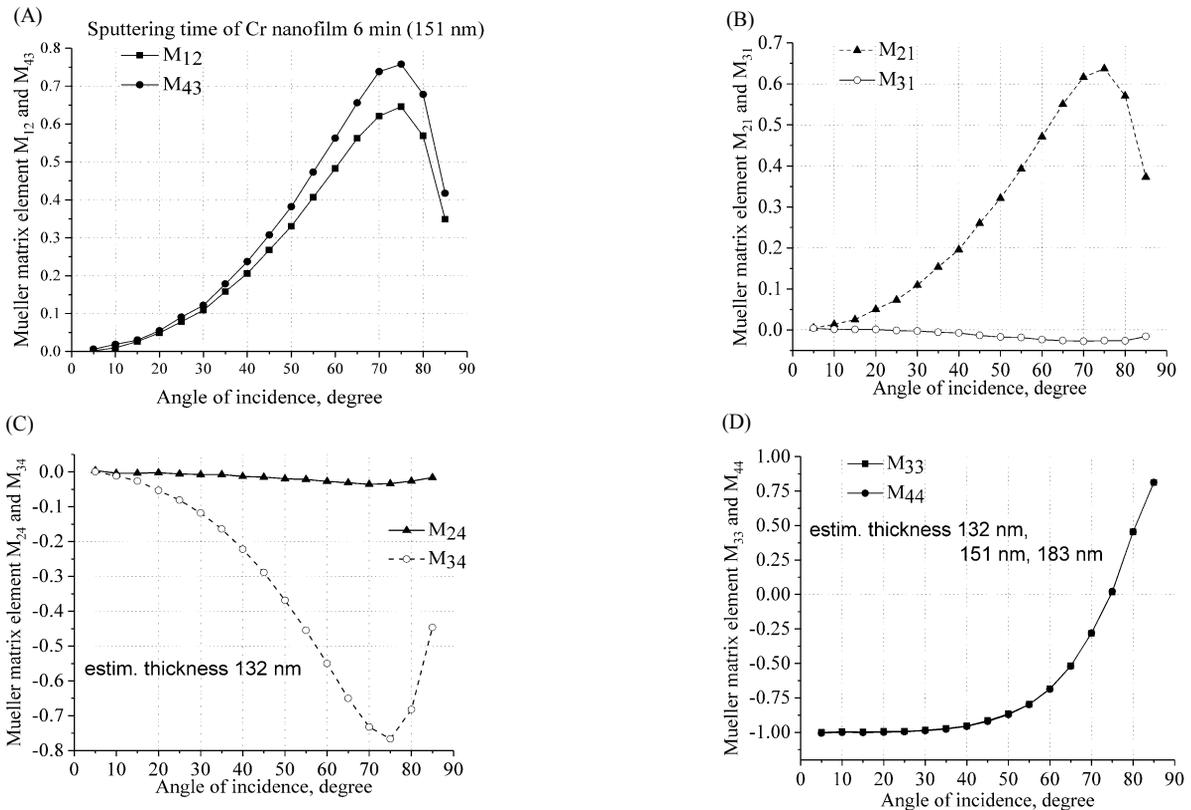


## CONCLUSION

The global maximum for the matrix elements $M_{12}$, $M_{43}$, $M_{21}$, $M_{31}$, $M_{24}$, $M_{34}$ was observed at the angle of incidence of 74.5°. If the residual scattering and absorption by the surface is neglected at this incidence angle, then Brewster's angle can be assumed to be equal to 74.5°.

LITERATURE
[1] G. Bader, P. V. Ashrit, and Vo-Van Truong, Applied Optics, **37** (7), pp. 1146-1151 (1998).