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Correlation between process parameters and layer properties of sub-stoichiometric Nb2O5-x Targets

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Sub stoichiometric targets of Nb_2O_{5-x} are used to produce optical coatings by DC magnetron sputtering. A big advantage could be a good process control with a relative small effort. Nb_2O_5 layers were deposited on highly transparent glass and silicon wafer substrates. The transparency has been correlated with different process parameters. One would imagine that additional oxygen is needed to produce a stoichiometric Nb_2O_5 layer out of sub-stoichiometric targets. Therefore a mixture of argon and oxygen as a reactive gas for the plasma has been used. In order to determine the minimal amount of oxygen needed, different ratios of argon to oxygen have been used for the deposition. It has been observed that it is also possible to produce highly transparent, stoichiometric layers by using pure argon gas. This can be achieved by lowering the energy per sputter-particle in the plasma. It was found that deposition at high process pressure causes a highly transparent layer to be formed. This may be due to the changing energy distribution of the plasma by increasing the process pressure. This effect has been investigated by Langmuir probe measurements correlated with transparency measurements. In addition HT-XRD has been investigated to detect secondary phases such as NbO or NbO_2.

Keywords
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