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Microwave Spectroscopy of the Muonium State in BeO

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The remarkable thermal, optical and mechanical properties of beryllium oxide lead to a number of applications, however little is known about the behaviour of hydrogen in BeO, which can be as high as 4% in thin films. We used positive muons as a model for hydrogen. Earlier TF data [1] shows both diamagnetic and muonium states and a large “missing fraction”.

We measured the muonium fraction using double electron-muon resonance and a novel design of microwave cell which allows low background “flypast” operation with a small sample. A single narrow resonance line is observed, with no resolved splitting due to nuclear coupling. The muonium fraction is found to be larger than that measured by TF-muSR - also unlike the decrease seen in the TF result, the amplitude increases slightly in the range 300-400K. Measurements with delayed RF pulses showed a small increase in muonium fraction at base temperature at later times.

[1] A. G. Marinopoulos et al., Phil. Mag. 97, 2108 (2017)

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