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Chemical vapor deposition of poly-*p*-xylylene in narrow tubes

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Depositing a film via chemical vapor deposition results in superior conformity compared with other deposition techniques, primarily due to the unique chemical interactions between the surface and the reactive compounds. This technique requires a readily accessible surface and so, if the transport of the reactive species is impeded, irrespective of whether this depletion is caused by diffusion or convective flow, a homogeneous layer thickness cannot be achieved. This is often the case when applying films to the interiors of tubes, especially tubes with a dead-end, such that the inevitable loss of film-building components leads to a drop in thickness along the deposition length. The present work examined the deposition of the organic polymer poly-*p*-xylylene, using a reactor with dimensions that were large compared with the mean free path and tubes in which this factor (the Knudsen number) becomes unity, such that the deposition can be approximately described with the continuum model.

A so-called temperature seesaw was employed to mitigate variations in layer thickness by generating an opposing temperature gradient. It was found that, under a vacuum of several tens of mTorr, the polymer could be deposited on the interior wall of a tube with an aspect ratio of at least 100 with an accuracy of ±7.5 %. The true ceiling temperature for the N derivate of this polymer was also determined to be 70 ± 2 °C. [http://dx.doi.org/10.1063/1.4994678]