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Diffusive boundary layers at the bottom of gaps and cracks MERLIN A ETZOLD, DAMTP, University of Cambridge, JULIEN R LANDEL, School of Mathematics, University of Manchester, STUART B DALZIEL, DAMTP, University of Cambridge — This work is motivated by the chemical decontamination of droplets of chemical warfare agents trapped in the gaps and cracks found in most man-made objects. We consider axial laminar flow within gaps with both straight and angled walls. We study the diffusive mass transfer from a source (e.g. a droplet surface) located at the bottom of the gap. This problem is similar to boundary layers and Graetz-type problems (heat transfer in pipe flow) with the added complication of a non-uniform lateral concentration profile due to the lateral variation of the velocity profile. We present 3D solutions for the diffusive boundary layer and demonstrate that a 2D mean-field model, for which we calculate series and similarity solutions, captures the essential physics. We demonstrate the immediate practical relevance of our findings by comparing decontamination of a droplet located in a gap and on an exposed surface [Landel et al., JFM (2016), vol. 789, pp. 630-668].

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