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Numerical Study of Turbulent Mass Transfer around a Rotating Stepped Cylinder DONG-HYEOG YOON, KYUNG-SOO YANG, Inha University, Korea, KLAUS BREMHORST, The University of Queensland, Australia — DNS was carried out to predict mass transfer in turbulent flow around a rotating stepped cylinder. This investigation is a follow-up study of Nesic et al, [Corrosion, Vol. 56, No. 10, pp. 1005 - 1014]. The original motivation of this work stemmed from the efforts to design a simple device which can generate flows of high turbulence intensity at low cost for corrosion researchers. We attempt to provide more detail of the flow structure and its interrelationship with the scalar field to assist with the understanding of this backward facing stepped flow of a rotating geometry. We consider Sc=1 and 10 both at Re=168. Here, Sc and Re stand for Schmidt number and Reynolds number, respectively, based on the step height and the surface speed of the cylinder upstream the step. Main focus was placed on the correlation between turbulent fluctuation and concentration field with particular reference to the wall layer. The spatio-temporal evolution of concentration field is discussed. Budgets for turbulent kinetic energy, scalar fluctuations and their respective dissipation rates at the locations of interest are also presented. The numerical results are qualitatively compared with those of the experiment conducted with the same flow configuration. This work was supported by the Korea Research Foundation Grant funded by the Korean Government (MOEHRD) (KRF-2005-041- D00122).

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