

# Effect of Particle Shape on Fluid Flow and Heat Transfer for Methane Steam Reforming Reactions in a Packed Bed (AIChE Journal, 2017 63(1), 366-377)

Karthik G. M. and Vivek V. Buwa

Dept. of Chemical Engineering, Indian Institute of Technology Delhi, New Delhi 110016, India

Numerical simulations of a cylindrical packed bed with tube to particle diameter ratio of 1.4, containing 10 particles, were performed to understand the effect of particle shape on pressure drop, heat transfer and reaction performance. Six particle shapes namely, cylinder as the reference, trilobe and daisy having external shaping, hollow cylinder, cylcut, and 7-hole cylinder including internal voids were chosen. Methane steam reforming reactions were considered for the heat transfer and reaction performance evaluation. The present study showed that the external shaping of particles offered lower pressure drop, but lower values of effectiveness factor indicating strong diffusion limitations. The internally shaped particles offered increased surface area, led to higher effectiveness factor and allowed to overcome the diffusion limitations. The effective heat transfer and effectiveness factor of the trilobe-shaped particle per unit pressure drop was found to be the best among the particle shapes considered in the present work.