RESEARCH PAPERS

用激光多普勒测速计（LDA）分析粘弹性对Metzner和Otto系数的影响

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摘要　The Metzner and Otto correlation is the single practical method for incorporating non-Newtonian effects in the mixing process. In this article, the Metzner and Otto′s idea, the role of viscoelasticity on the Metzner and Otto coefficient, ks, effects of flow regime on ks and the determination of ks for Rushton turbine impeller have been studied using the direct method of the laser Doppler anemometry (LDA) velocity meusurement for the case of viscoelastic liquids. The normalized mean tangential velocity profiles are independent of Rushton turbine impeller speeds. Contrary to literature findings, it is shown that the variation of local shear rate against the impeller speed is better correlated by the power equation, i.e. $= ks'.Nb'$, in the transition region, i.e. $\sim 30 < Re <\sim 2000$.Also, a correlation between improved coefficient, ks′, and the elasticity number of viscoelastic liquids is given which is very helpful in designing of the mixing of both viscoelastic and inelastic non-Newtonian fluids through relating rheological properties to kinematical and dynamical parameters of the mixing process.

关键词　viscoelastic　mixing　Rushton turbine impeller　laser Doppler anemometry (LDA)　Metzner and Otto coefficient

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Investigation of the Viscoelastic Effect on the Metzner and Otto Coefficient Through LDA Velocity Measurements

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Abstract The Metzner and Otto correlation is the single practical method for incorporating non-Newtonian effects in the mixing process. In this article, the Metzner and Otto' s idea, the role of viscoelasticity on the Metzner and Otto coefficient, ks, effects of flow regime on ks and the determination of ks for Rushton turbine impeller have been studied using the direct method of the laser Doppler anemometry (LDA) velocity meusurement for the case of viscoelastic liquids. The normalized mean tangential velocity profiles are independent of Rushton turbine impeller speeds. Contrary to literature findings, it is shown that the variation of local shear rate against the impeller speed is better correlated by the power equation, i.e. $= ks'.Nb'$, in the transition region, i.e. $\sim 30 < Re <\sim 2000$.Also, a correlation between improved coefficient, ks′, and the elasticity number of viscoelastic liquids is given which is very helpful in designing of the mixing of both viscoelastic and inelastic non-Newtonian fluids through relating rheological properties to kinematical and dynamical parameters of the mixing process.

Key words viscoelastic; mixing; Rushton turbine impeller; laser Doppler anemometry (LDA); Metzner and Otto coefficient

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