

A note to further explain the mechanism of turbulent flow drag reduction by polymer from chemistry view

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Abstract

In our previous work regarding the mechanism of drag reduction and degradation by flexible linear polymers, we proposed a correlation based on the Fourier series to predict the drag reduction and its degradation, where a phase angle was involved, but the physical meaning for the correlation especially of the employed phase angle was not clear, which is however important for reasonable explanation of the drag reduction mechanism over flexible linear polymers. This letter aims to clarify this issue. We use several steps of deduction from the viscoelastic theory, and conclude that the Fourier series employed to predict the drag reduction and its degradation is due to viscoelastic property of drag-reducing polymer solution, and the phase angle represents the hysteresis of polymer in turbulent flow. Besides, our new view of drag reduction by flexible polymers can also explain why a maximum drag reduction in rotational flow appears before degradation happens.

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