

论文

## 疏水缔合效应对聚丙烯酰胺类水溶液结构和流变性质的影响

孙焕泉, 张坤玲, 陈静, 曾胜文, 平郑骅, 许元泽

中国石化胜利油田地质科学研究院; 聚合物分子工程教育部重点实验室复旦大学高分子科学系; 聚合物分子工程教育部重点实验室复旦大学高分子科学系 东营

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**摘要** 以聚合物驱油为背景,研究了部分水解聚丙烯酰胺(HPAM)和缔合型部分水解聚丙烯酰胺(AHPAM)水溶液的结构与流变性质的差别.通过粘度法和静态激光光散射法得到了所分析的聚丙烯酰胺的分子量,用动态激光光散射法和粘度法分析了特定AHPAM分子缔合形态,并用流变学法测定了AHPAM在地层温度与矿化度条件下的线性粘弹性与非线性流变特性.着重讨论了临界缔合浓度的概念,研究了结构和流变性质的关系,以及分析了缔合对聚合物驱油的可能影响.实验结果表明,AHPAM水溶液在宽浓度范围存在分子缔合;一般临界缔合浓度的概念实际反映在进入亚浓溶液范围分子间缔合的效应,剪切速率约为 $10\text{s}^{-1}$ 时,剪切粘度突降数倍,反映缔合结构在剪切场中的变化,该现象在高缠结浓度下较不明显;拉伸粘度随拉伸速率变化与HPAM定性不同,该拉伸特性反映了疏水缔合近程作用的本质.

**关键词** [缔合型部分水解聚丙烯酰胺](#) [临界缔合浓度](#) [流变性](#) [强化采油](#) [聚合物驱油](#)

分类号

## EFFECT OF HYDROPHOBIC ASSOCIATION ON STRUCTURE AND RHEOLOGICAL BEHAVIORS OF POLYACRYLAMIDE BASED AQUEOUS SOLUTIONS

SUN Huanquan<sup>1</sup>,ZHANG Kunling<sup>2</sup>,CHEN Jing<sup>2</sup>,ZENG Shengwen<sup>1</sup>,PING Zhenghua<sup>2</sup>,XU Yuanze<sup>2</sup>

1 *Geological Scientific Research Institute Shengli Oilfield; SINOPEC; Dongying 257015*;2 *Key Laboratory of Molecular Engineering of Polymers of Ministry of Education; Department of Macromolecular Science; Fudan University; Shanghai 200433*

**Abstract** Partial hydrolyzed polyacrylamide(HPAM)and associating partial hydrolyzed polyacrylamide(AHPAM) were compared focusing on the structure and rheology relations,which play important roles in enhanced oil recovery.The molecular associating state in AHPAM aqueous solutions is studied in terms of molecular weight measured by intrinsic viscosity and static light scattering method,associate size and behaviors by the dynamic light scattering and viscosity method,as well as the rheological properties at various concentrations,temperature and salinity.The results on AHPAM aqueous solution reveal that the association exists in broad concentrations. It is suggested that the concept of critical association concentration should be related to the range of semi-dilute to entangled region rather than the starting concentration of hydrophobic association. The change of the associating structure under shear was reflected in the shear viscosity which dropped down suddenly,when the shear rate was up to  $10\text{ s}^{-1}$ ,but this phenomenon became less evident at highly entangled concentrations. In addition,the elongational viscosity of AHPAM in converging flow decreased with flow rate and also reflected the intrinsic feature of short range interaction of the association. The relevant influences of polymeric hydrophobic association on the enhanced oil recovery were discussed.

**Key words** [Associating partial hydrolyzed polyacrylamide](#) [Critical association concentration](#) [Rheology](#) [Enhanced oil recovery](#) [Polymer flooding](#)

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通讯作者 许元泽

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