

研究论文

## DSB显著提高羧酸盐驱油体系抗钙镁离子能力的研究

徐军<sup>1,2</sup>, 孙文起<sup>3</sup>, 李干佐<sup>1</sup>, 徐健<sup>1</sup>, 郑利强<sup>1</sup>, 王红勤<sup>2</sup>, 张高勇<sup>1</sup>

1. 山东大学胶体与界面化学教育部重点实验室, 济南 250100;
2. 金陵石化有限责任公司研究院, 南京 210046; 3. 山东大学理论与计算化学研究所, 济南 250100

收稿日期 2006-5-27 修回日期 网络版发布日期 2007-3-1 接受日期

**摘要** 测定了工业品级的天然混合长链烷基羧酸盐(SDC)以及与3-(*N,N*-二甲基十二烷基胺)-2-羟基-丙磺酸(DSB)复配驱油体系的界面张力( $ITF_{min}$ ), 分别得出其抗钙镁离子的能力为400和5000 mg/L. 选择试剂级十二烷基羧酸钠与DSB复配, 测定了不同配比溶液的表面张力值和临界胶束浓度cmc, 结合长链烷基脂肪酸与钙离子的溶度积 $K_{sp}$ , 分析了对不溶性长链烷基羧酸盐形成的影响. 根据现场驱油体系配方, 计算了两者在溶液中的摩尔配比为4:1时的十二烷基羧酸盐在胶束中的摩尔分数 $x_{m1}$ 为0.51, 相互作用参数 $\beta^m$ 值为-3.11, 反映了两者有较强的相互作用. 采用量子化学方法, 对由1个十二烷基羧酸分子、1个DSB分子及1个二价钙离子组成的模型复合物进行了能量计算和电荷分布计算, 得出在长链烷基羧酸盐和DSB两者混合胶束的界面层中存在负电荷空穴, 提出二价金属离子被络合的模型, 合理地解释了实验事实.

**关键词** [溶度积](#) [胶团](#) [抗钙镁离子能力](#)

**分类号** [0647.2](#)

## Investigation in Extremely Improved Ability of Resisting $Ca^{2+}$ and $Mg^{2+}$ for Alkyl Carboxylates Flooding System with Adding DSB

XU Jun<sup>1,2</sup>, SUN Wen-Qi<sup>3</sup>, LI Gan-Zuo<sup>1</sup>, XU Jian<sup>1</sup>, ZHENG Li-Qiang<sup>1</sup>, WANG Hong-Qin<sup>2</sup>, ZHANG Gao-Yong<sup>1</sup>

1. Key Laboratory for Colloid and Interface Chemistry of Ministry of Education, Shandong University, Jinan 250100, China;
2. Research Institute of Jinling Petrochemical Co., Nanjing 210046, China;
3. Institute of Theoretical Chemistry, Shandong University, Jinan 250100, China

**Abstract** The natural mixed carboxylates(abbreviated as SDC) can be used to extremely improve the ability of resisting  $Ca^{2+}$  and  $Mg^{2+}$  when adding 3-(*N,N*-dimethyldodecylammonio)-2-hydroxy-propanesulfonate(abbreviated as DSB). SDC and SDC-DSB flooding system are tolerant to  $Ca^{2+}$  and  $Mg^{2+}$  up to 400 mg/L and  $5.0 \times 10^3$  mg/L respectively. Their  $ITF_{min}$  are  $10^{-3}$  mN/m, and the oil recovery reach 20% by using the core flood experiment. The surface tension and the critical micelle concentrations were measured for the systems of the sodium dodecanoate and DSB. By analysis the solubility product( $K_{sp}$ ) of fatty acid salt, we can know that the concentration of  $Ca^{2+}$  and  $Mg^{2+}$  ions in solution is increased along with the decrease of concentration of free fatty acid group. The interaction parameter  $\beta^m$  between sodium dodecanoate and DSB can be calculated as -3.111, which reflects more strong reaction force. The mole fraction  $x_{m1}$  of sodium dodecanoate in the mixed micelles is 0.51. By the software Gaussian 03, we calculated the minimum energy for compound of DSB/dodecyl acid/ $Ca^{2+}$ , and obtained the charge

### 扩展功能

本文信息

▶ [Supporting info](#)

▶ [PDF\(635KB\)](#)

▶ [\[HTML全文\]\(0KB\)](#)

▶ [参考文献](#)

服务与反馈

▶ [把本文推荐给朋友](#)

▶ [加入我的书架](#)

▶ [加入引用管理器](#)

▶ [复制索引](#)

▶ [Email Alert](#)

▶ [文章反馈](#)

▶ [浏览反馈信息](#)

相关信息

▶ [本刊中 包含“溶度积”的 相关文章](#)

▶ 本文作者相关文章

· [徐军](#)

· [孙文起](#)

· [李干佐](#)

· [徐健](#)

· [郑利强](#)

· [王红勤](#)

· [张高勇](#)

e of dominating atom in this compound. These results show there are probably many “negative-charge hole” in the surface layer of micelle, thus, the  $\text{Ca}^{2+}$  and  $\text{Mg}^{2+}$  in solution can combine in the surface layer of micelles. So we can explain why the alkyl carboxylates flooding system extremely improved the ability of resisting to  $\text{Ca}^{2+}$  and  $\text{Mg}^{2+}$  with adding DSB.

**Key words** [Solubility product](#) [Micelle](#) [Ability of resisting  \$\text{Ca}^{2+}\$  and  \$\text{Mg}^{2+}\$](#)

DOI:

---

通讯作者 李干佐 [coliw@sdu.edu.cn](mailto:coliw@sdu.edu.cn)