

課題番号 : F-15-NM-0001
 利用形態 : 技術補助
 利用課題名 (日本語) : 流れ方向に温度勾配を持つ流路における化学的消炎効果に関する研究
 Program Title (English) : Investigation of wall chemical effect in a micro channel with streamwise temperature gradient
 利用者名(日本語) : 万 遂
 Username (English) : WAN Sui
 所属名(日本語) : 東京大学・大学院工学系研究科・機械工学専攻
 Affiliation (English) : Department of Mechanical Engineering, The University of Tokyo

1. 概要 (Summary)

Wall chemical effect on weak flames in a rectangular micro channel with a streamwise temperature gradient has been investigated. The weak flame exists at the mean flow velocity lower than 4 cm/s. Near-wall OH radical distributions in the 2nd hot flame zone of the dimethyl ether (DME)/air weak flame were captured by using the planar laser-induced fluorescence (PLIF) technology.

2. 実験 (Experimental)

【利用した主な装置】

- Atomic Layer Deposition System (ALD system)

【実験方法】

In order to exclude the surface roughness influence on chemical adsorption, ALD is used for alumina film deposition. A 100nm-thick alumina layer is deposited on the inner surface of the quartz channel under the usual condition (8.2sec/cycle) with a temperature of 300°C. Trimethylaluminum (TMA) has been used as the Al precursor and H₂O works as the oxygen precursor.

3. 結果と考察 (Results and Discussion)

Figure 1 shows OH distributions calculated from the OH-PLIF images of the 2nd hot flame zone of the DME/air weak flame in the quartz-quartz channel, the Type 321 stainless steel (SUS321)-quartz channel and the alumina-quartz channel. OH distribution for identical chemical boundary on both sidewalls (quartz-quartz channel case) is symmetric. On the other hand, OH distribution in the SUS321-quartz channel case becomes obviously asymmetric. And a slightly higher OH

concentration is found over the alumina surface. It indicates that the surface reaction has finite effect on the radical distribution even for the weak flame.

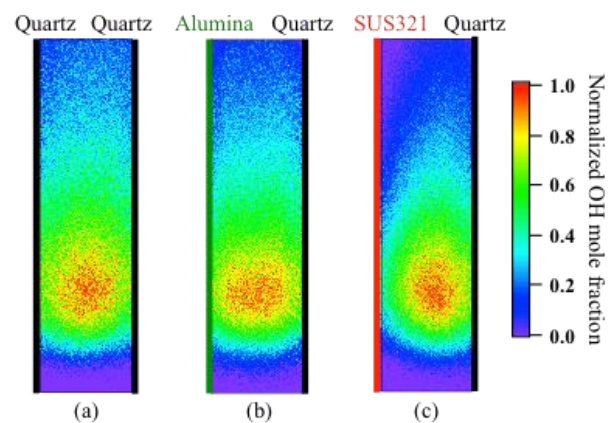


Figure 1. Normalized OH mole fraction distributions for DME/air weak flames ($U_m = 2$ cm/s, $\phi = 0.85$) in a 1.5-mm-high micro channel. (a) Quartz-quartz channel, (b) alumina-quartz channel and (c) SUS321-quartz channel. Alumina and SUS321 are on the left sidewall.

4. その他・特記事項 (Others)

なし

5. 論文・学会発表 (Publication/Presentation)

- (1) S. WAN, Y. Fan, K. Maruta, Y. Suzuki, The 52nd National Heat Transfer Symposium of Japan, May. 19, 2015.
- (2) S. WAN, Y. Fan, K. Maruta, Y. Suzuki, The 10th Asia-Pacific Conference on Combustion, Jul. 21, 2015.
- (3) S. WAN, Y. Fan, K. Maruta, Y. Suzuki, The 53rd Symposium (Japanese) on Combustion, Nov. 16, 2015.

6. 関連特許 (Patent)

なし