

## プラズモニックチップにおける光化学反応促進と蛍光増強

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Enhanced Fluorescence and Promoted Photochemical Reactions on a Plasmonic Chip  
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In our laboratory, a 10-fold bright fluorescence image was obtained with a silver-coated plasmonic chip which has a wavelength-size periodic structure. In this study, *O*-methyl benzaldehyde(*O*-MBA) substituents of photoreactive molecule modified to the aminated Bull's eye-type plasmonic chip photochemically reacted with fluorescently-labeled maleimide molecule (Cy5-M) after UV light irradiation with an upright-inverted microscope. Fluorescence intensity on the Bull's eye pattern within UV spot area ( $B_{in}(t)_{ave}$ ) and that on the flat metal within UV spot area ( $F_{in}(t)_{ave}$ ) were evaluated. As a result of fitting  $B_{in}(t)_{ave}$  and  $F_{in}(t)_{ave}$  to the first-order reaction rate equation, it was found that the reaction was accelerated 4.0 times by using the plasmon field.

**Keywords :** Plasmon, Microscopy, Photochemical Reaction, Enhanced Fluorescence

これまで当研究室では、銀と SiO<sub>2</sub> をコーティングした波長サイズの周期構造を有するプラズモニックチップをバイオ検出に応用し、増強電場によって増強蛍光像を得た。本研究では、この増強電場を光化学反応促進にも利用し、より高感度な蛍光検出を目指した。同心円構造の Bull's eye が配列したプラズモニックチップに光反応性化合物 (*O*-MBA) を修飾した後、正倒立蛍光顕微鏡下でチップ裏面から UV 光を  $t$  秒間照射し、中間体を生成した。これに蛍光標識 maleimide 分子 (Cy5-M) を加え、反応させた。反応後の Cy5 の蛍光像を Fig.1 に示す。Fig.1 の赤色の破線は光照射スポットで、スポット内の Bull's eye パターン上の蛍光強度  $B_{in}(t)$  と平坦な金属面上の蛍光強度  $F_{in}(t)$  を照射時間に対してプロットし、1 次反応速度式でフィッティングした結果 (Fig.2)、プラズモン場を利用した光化学反応が 4.0 倍促進したことが分った。

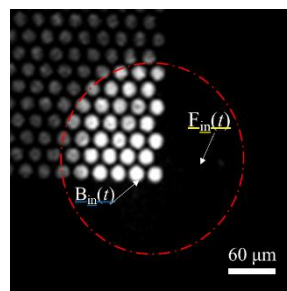


Fig.1. Fluorescence image of Cy5: UV irradiation spot (dashed red circle).

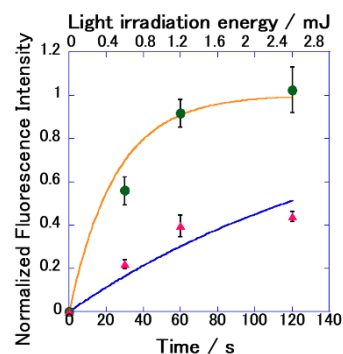


Fig.2. Normalized  $B_{in}(t)_{ave}$  (green circle) and  $F_{in}(t)_{ave}$  (pink triangle) plotted against the UV irradiation time. The orange and blue lines represent the fitting curves to  $B_{in}(t)_{ave}$  and  $F_{in}(t)_{ave}$ , respectively.