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利用形態　　:機器利用
利用課題名（日本語）　　:ナノギャップ金 2 量体構造に誘起されるプラズモン誘起光圧の解析
Program Title (English)　　:Analyses of plasmon-induced optical force induced by Au nanogap dimers
利用者名（日本語）　　:管禹童
Username (English)　　:Guan Yutong
所属名（日本語）　　:北海道大学総合化学院
Affiliation (English)　　:Graduation School of Chemical Sciences and Engineering, Hokkaido University
キーワード／Keyword　　:「リソグラフィ・露光・描画装置」、「成膜・膜堆積」、「分析」、「フォトニクス」

1. 概要（Summary）

To construct a highly sensitive chemical sensor using plasmons, it is indispensable to concentrate nanomaterials in metallic nanostructures. In this study, fluorescence correlation spectroscopy (FCS) was used for evaluating the potential of plasmon-induced optical trapping.

2. 実験（Experimental）

【利用した主な装置】

・超高精度電子ビーム描画装置 100 KV
・多元スパッタ装置
・高分解能電界放射型走査型電子顕微鏡

【実験方法】

Au nanogap dimer has been fabricated by electron beam lithography and lift-off techniques on the glass substrate. Fluorescent polystyrene beads with a diameter of 40 nm were employed for evaluating the plasmon-induced optical trapping. The fluorescent beads were dispersed in aqueous solution. Fluorescence correlation spectroscopy (FCS) has been employed for measuring the plasmon-induced optical force. 870 nm CW laser beam was used for inducing the plasmon-induced optical force and 488 nm CW laser was used for the excitation of fluorescence. Time-correlated single photon counting module was used for the measurement of FCS curve with a time interval of 25 ns.

3. 結果と考察（Results and Discussion）

A typical scanning electron microscope image of Au nanogap dimer is shown in Fig. 1. It indicates that Au nanogap dimer with a gap width of 5 nm has been successfully fabricated.

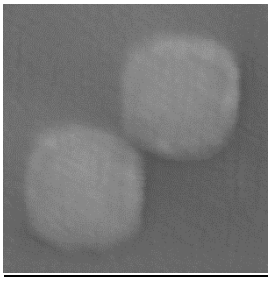

Fig. 1. A SEM image of Au nanogap dimer on the glass substrate.

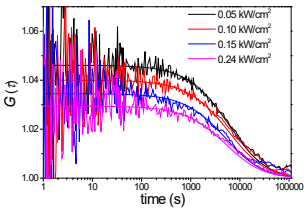

Fig. 2. FCS curve

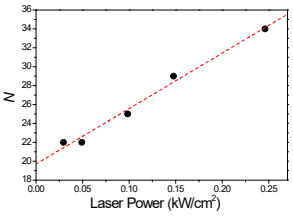

Fig. 3. Trapped number

FCS curves measured with different trapping laser powers are shown in Fig. 2. The intercept of FCS represents 1 + 1/N (N is the number of trapped particles), and the value of N increases as the concentration of fluorescent beads progresses as the laser power increases. Fig. 3 is a plot of N against the trapping laser power. It was clearly demonstrated that the number of trapped particles increased almost linearly with the trapping laser power. The trapping potential is derived from the Boltzmann distribution function, which is in good agreement with the theoretical estimation.

4. その他・特記事項（Others）

共同研究者: 上野貢生、藤井 翔、平光勇気

5. 論文・学会発表（Publication/Presentation）

1. 平光勇気, 藤井 翔, 上野貢生, “電子顕微鏡を用いたプラズモン誘起オプティカルトラッピングの計測”, 化学系学協会北海道支部 2021 年冬季研究発表会, 1 月 (2021).

6. 関連特許（Patent）

なし