

課題番号 : F-21-UT-0012  
利用形態 : 機器利用  
利用課題名(日本語) :  
Program Title (English) : Quantum Emission Assisted by Energy Landscape Modification in Pentacene-Decorated Carbon Nanotubes  
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キーワード/Keyword : carbon nanotubes, organic molecules, lithography, リソグラフィ・露光・描画装置

## 1. 概要(Summary)

By growing coronene particles with controllable sizes on pentacene-decorated carbon nanotubes, we demonstrate the creation of local potential wells as deep as  $\sim 30$  meV that can be used to trap free excitons at room temperature.

## 2. 実験(Experimental)

### 【利用した主な装置】

高速大面積電子線描画装置、クリーンドラフト潤沢超純水付、高速シリコン深掘りエッチング装置、ステルスダイサー

### 【実験方法】

Trenches on the Si wafer are patterned by electron-beam lithography followed by dry etching. The trench length is 900  $\mu\text{m}$ , and the width is 0.5-4.0  $\mu\text{m}$ . Single-walled carbon nanotubes suspended across such trenches are then synthesized by alcohol chemical vapor deposition. Nanoscale pentacene particles are first decorated onto the air-suspended carbon nanotubes, then coronene is adsorbed onto the pentacene particles

by thermal evaporation. A home-built photoluminescence system is used to characterize the optical properties of the carbon nanotubes.

## 3. 結果と考察(Results and Discussion)

The depths of potential wells increase as a function of the diameter of the coronene particle. Signs of exciton transfer from the undecorated region to the decorated site are observed at all potential well depths.

## 4. その他・特記事項(Others)

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## 5. 論文・学会発表(Publication/Presentation)

[1] Z. Li, K. Otsuka, D. Yamashita, D. Kozawa, and Y. K. Kato, "Quantum Emission Assisted by Energy Landscape Modification in Pentacene-Decorated Carbon Nanotubes", ACS Photonics, 2021, DOI: 10.1021/acsp Photonics.1c00539.

## 6. 関連特許(Patent)

なし

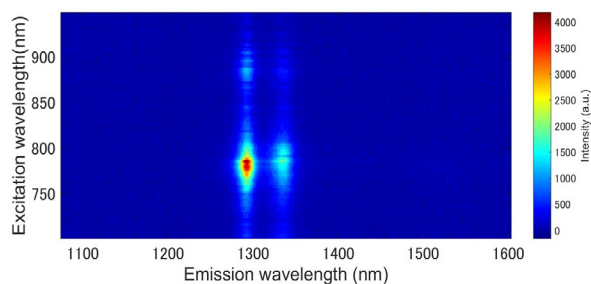


Fig. 1 Photoluminescence excitation map of a typical carbon nanotube decorated with a pentacene/coronene particle.