

マテリアル先端リサーチインフラ利用報告書

ARIM User's Report

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課題データ / Project Data

課題番号 Project Issue Number	23KU1018
利用課題名 Title	様々な数のPtナノ粒子を有するAu@Ag-Ptコア@マルチシェルナノ粒子の触媒特性の評価
利用した実施機関 Support Institute	九州大学
機関外・機関内の利用 External or Internal Use	内部利用（ARIM事業参画者以外）/Internal Use (by non ARIM members)
横断技術領域 Cross-Technology Area	物質・材料合成プロセス/Molecule & Material Synthesis
重要技術領域 Important Technology Area	次世代ナノスケールマテリアル/Next-generation nanoscale materials 革新的なエネルギー変換を可能とするマテリアル/Materials enabling innovative energy conversion
キーワード Keywords	赤外・可視・紫外分光/ Infrared/visible/ultraviolet spectroscopy,環境発電/ Energy Harvesting, ナノ粒子/ Nanoparticles

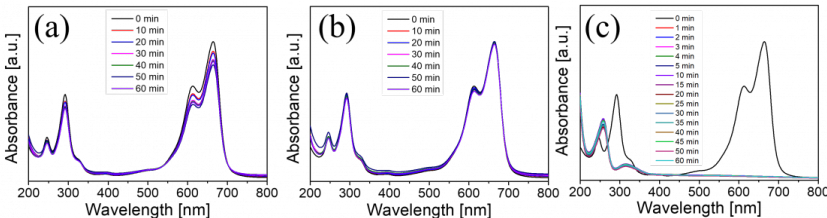
利用者と利用形態 / User and Support Type

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共同利用者氏名 Names of Collaborators in Other Institutes Than Hub and Spoke Institutes	
ARIM実施機関支援担当者 Names of Collaborators in The Hub and Spoke Institutes	柿田 有理子
利用形態 Support Type	機器利用/Equipment Utilization,技術補助/Technical Assistance

利用した主な設備 / Equipment Used in This Project

利用した主な設備 Equipment ID & Name	KU-505 : 紫外可視近赤外分光測定装置装置群
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報告書データ / Report

<p>概要 (目的・用途・実施内容) Abstract (Aim, Use Applications and Contents)</p>	<p>Au@Ag-Pt core@multi-shell nanoparticles (NPs) were synthesized using a co-reduction method, and their catalytic activity was evaluated towards the reduction of methylene blue (MB) dye. The catalytic activity of Au@Ag-Pt core@multi-shell NPs for the reduction of MB dye in the presence of NaBH₄, as a reduction agent, was studied using a Uv-vis spectrophotometer. Au@Ag-Pt core@multi-shell NPs showed excellent catalytic activity, with reduction completed within 1 minute. Therefore, Au@Ag-Pt core@multi-shell NPs are potential candidates for the reduction of dye in real waste to their outstanding catalytic activity.</p>
<p>実験 Experimental</p>	<p>Reduction of methylene blue (MB) dye by sodium borohydride (NaBH₄) was performed in the presence of Au@Ag-Pt core@multi-shell NPs to test the catalytic activity of Au@Ag-Pt core@multi-shell NPs. 5 ml of MB (0.1 mM) dye and 0.5 ml of NaBH₄ (0.05 M) solutions were mixed followed by the addition of Au@Ag-Pt NPs (0.4 ml, 0.01 mM). Uv-visible double-beam spectrophotometer was used to monitor the reaction progress by recording the time-dependent Uv-vis absorption spectra of these mixtures at 664 nm in a quartz cuvette (path length 1 mm). The Uv-vis spectrum was investigated at regular time intervals for this mixture, and the reduction of MB was found to be complete in just 1 minute. A similar procedure was followed in the absence of Au@Ag-Pt NPs and NaBH₄ to examine the catalytic activity and role of Au @Ag-Pt NPs. Scanning was performed in the range of 200-800 nm at room temperature.</p>
<p>結果と考察 Results and Discussion</p>	<p>The catalytic reduction performance of NPs was evaluated for the reduction of MB dye to Leucomethylene blue (LBM) by using NaBH₄ as the reduction agent. To confirm the catalytic role of NPs, the Uv-vis absorption spectra for the reduction of MB dye in the absence of NPs and NaBH₄ were measured as shown in Figure 1, and exhibit a characteristic absorption peak at 664 nm assigned to the 664 nm ($\pi-\pi^*$) and 612 nm ($n-\pi^*$) [1]. The reduction rate of MB dye was very slow in the absence of NPs, and the characteristic peak at 664 nm was still presented after 60 minutes of reaction as shown in Figure 1a. The absorption peak at 664 nm was constant in the absence of NaBH₄, indicating that no additional reaction exists between MB dye and Au@Ag-Pt NPs as shown in Figure 1b. As a result, it is obvious that neither NPs nor NaBH₄ alone can convert MB dye to LMB, and expected that NPs will act as a catalyst to activate the reaction in the reduction carried out by NaBH₄.</p>
<p>図・表・数式 1 Figures, Tables and Equations 1</p>	 <p>Fig. 1. The Uv-vis absorption spectra for reducing MB dye in the absence of NPs (a), NaBH₄ (b), and in the presence of 0.4 ml of NPs with NaBH₄(c).</p>
<p>その他・特記事項 (参考文献・謝辞等) Remarks(References and Acknowledgements)</p>	<p>[1] C. Sharma, S. Ansari, M.S. Ansari, S.P. Satsangee, M.M. Srivastava, Single-step green route synthesis of Au/Ag bimetallic nanoparticles using clove buds extract: Enhancement in antioxidant bio-efficacy and catalytic activity, Materials Science and Engineering C 116 (2020). https://doi.org/10.1016/j.msec.2020.111153.</p>

成果発表・成果利用 / Publication and Patents

<p>DOI (論文・プロシーディング) DOI (Publication and Proceedings)</p>	
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口頭発表、ポスター発表 および、その他の論文 Oral Presentations etc.	
特許出願件数 Number of Patent Applications	0件
特許登録件数 Number of Registered Patents	0件