Enhanced reverse saturable absorption in graphene/Ag\(_2\)S organic glasses

Supplementary Material

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NLA properties of Ag$_2$S, graphene, and G/Ag$_2$S solution in DMF

Fig. S1 shows the open-aperture Z-scan experimental data and theoretical curves (solid line) of Ag$_2$S, graphene, and G/Ag$_2$S solution in dimethylformamide (DMF). In the Z-scan measurements, to keep closer linear transmittance with the (G/Ag$_2$S)$_{7.8}$/PMMA, we controlled the concentrations of Ag$_2$S, graphene, and G/Ag$_2$S solution in DMF to be 0.5 mg/mL, 0.03 mg/mL, and 0.08 mg/mL, respectively. The input energy was 66 μJ. It is obvious that the dip of the open-aperture Z-scan curve for the G/Ag$_2$S solution in DMF is the largest, suggesting that the G/Ag$_2$S solution in DMF exhibits the strongest nonlinear absorption properties.

![Graph showing comparison of open-aperture Z-scan curves among Ag$_2$S, graphene, and G/Ag$_2$S solution in DMF.](image)

Fig. S1 (Color online) Comparison of open-aperture Z-scan curves among Ag$_2$S, graphene, and G/Ag$_2$S solution in DMF.

The values of linear transmittance $T_0$, linear absorption $\alpha_0$ at 532 nm, and effective nonlinear absorption (NLA) coefficient $\beta_{\text{eff}}$ of Ag$_2$S, graphene, and G/Ag$_2$S solution in DMF were listed in Table S1. Though $T_0$ value of the G/Ag$_2$S ($T_0 = 47.3\%$) solution in DMF is smaller than those of Ag$_2$S solution in DMF ($T_0 = 52.8\%$) and
graphene solution in DMF ($T_0 = 55.9\%$), the $\beta_{\text{eff}}$ value of the G/Ag$_2$S solution in DMF is approximately 5.0 and 2.9 times larger than those of Ag$_2$S solution in DMF and graphene solution in DMF, respectively. The results above indicates that the G/Ag$_2$S solution in DMF exhibit enhanced NLA properties compared to Ag$_2$S solution in DMF and graphene solution in DMF.

**Table S1** Comparison of linear transmittance $T_0$, linear absorption coefficient $\alpha_0$ at 532 nm, and nonlinear absorption coefficient $\beta_{\text{eff}}$ among Ag$_2$S, graphene, and G/Ag$_2$S solution in DMF.

<table>
<thead>
<tr>
<th>Samples</th>
<th>$T_0$ (%)</th>
<th>$\alpha_0$ (cm$^{-1}$)</th>
<th>$\beta_{\text{eff}}$ (cm/GW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ag$_2$S in DMF</td>
<td>52.8</td>
<td>0.638</td>
<td>21.4</td>
</tr>
<tr>
<td>Graphene in DMF</td>
<td>55.9</td>
<td>0.582</td>
<td>37.5</td>
</tr>
<tr>
<td>G/Ag$_2$S in DMF</td>
<td>47.3</td>
<td>0.748</td>
<td>107</td>
</tr>
</tbody>
</table>

The concentration of Ag$_2$S solution in DMF, graphene solution in DMF, and G/Ag$_2$S solution in DMF are 0.5 mg/mL, 0.03 mg/mL, and 0.08 mg/mL, respectively.