Aspects of Water Splitting Mechanism on (Ga$_{1-x}$Zn$_x$)(N$_{1-x}$O$_x$) Photocatalyst Modified with Rh$_{2-y}$Cr$_y$O$_3$ Cocatalyst

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Figure S1. Time course of overall light and heavy water splitting reactions on Rh$_{2-y}$Cr$_{y}$O$_{3}$/(Ga$_{1-x}$Zn$_{x}$)(N$_{1-x}$O$_{x}$). Reaction conditions: catalyst, 0.10 g; solution, 140 mL adjusted to pH 4.5 by H$_2$SO$_4$; light source, 300 W Xe lamp (300 nm $< \lambda < 500$ nm, $7 \times 10^{21}$ photon h$^{-1}$).
**Figure S2.** Time course of H\textsubscript{2} and D\textsubscript{2} evolution reactions from light and heavy water solutions of 5 mM (COOH\textsubscript{2}) and 45 mM (COONa\textsubscript{2}) on Rh\textsubscript{2-y}Cr\textsubscript{y}O\textsubscript{3}/(Ga\textsubscript{1-x}Zn\textsubscript{x})(N\textsubscript{1-x}O\textsubscript{x}). Reaction conditions: catalyst, 0.10 g; solution, 140 mL; light source, 300 W Xe lamp (300 nm < \lambda < 500 nm, 4 \times 10^{21} photon h\textsuperscript{-1}).
Figure S3. Time course of H₂ and D₂ evolution reactions from 10 vol.% CH₃OH light water solutions and 10 vol.% CH₃OD heavy water solutions on Rh₂₋₃CrₓO₃/(Ga₁₋ₓZnₓ)(N₁₋ₓOₓ). Reaction conditions: catalyst, 0.10 g; solution, 140 mL; light source, 300 W Xe lamp (300 nm < λ < 500 nm, 4 × 10²¹ photon h⁻¹).
Figure S4. Time course of H\textsubscript{2} and D\textsubscript{2} evolution reactions from light and heavy water solutions of 50 mM HCOONa solution on Rh\textsubscript{2},Cr\textsubscript{3}O\textsubscript{5}/(Ga\textsubscript{1-x}Zn\textsubscript{x})(N\textsubscript{1-x}O\textsubscript{x}). Reaction conditions: catalyst, 0.10 g; solution, 140 mL; light source, 300 W Xe lamp (300 nm < \lambda < 500 nm, 4 \times 10^{21} \text{ photon h}^{-1}).
**Figure S5.** Time course of O$_2$ evolution reaction from light and heavy water solutions of 50 mM AgNO$_3$ on Rh$_{2.3}$Cr$_3$O$_{12}$/(Ga$_{1-x}$Zn$_x$)(N$_{1-x}$O$_x$). Reaction conditions: catalyst, 0.10 g; solution, 140 mL; light source, 300 W Xe lamp (300 nm $< \lambda < 500$ nm, $4 \times 10^{21}$ photon h$^{-1}$).
**Figure S6.** Temperature dependence of the photocatalytic activity for the H$_2$ evolution reaction from aqueous CH$_3$OH solutions on Rh$_{2-y}$Cr$_y$O$_{3-y}$/(Ga$_{1-x}$Zn$_x$)(N$_{1-x}$O$_x$). Reaction conditions: catalyst, 0.10 g; 80 vol.% CH$_3$OH aqueous solution, 140 mL; light source, 300 W Xe lamp (300 nm < $\lambda$ < 500 nm).
Figure S7. Temperature dependence of the photocatalytic activity for the H2 evolution reaction from aqueous C2H5OH solutions on Rh2-xCr3O3/(Ga1-xZn)(N1-xOx). Reaction conditions: catalyst, 0.10 g; 10 vol.% C2H5OH aqueous solution, 140 mL; light source, 300 W Xe lamp (300 nm < λ < 500 nm).
Figure S8. Temperature dependence of the photocatalytic activity for the O₂ evolution reaction from aqueous AgNO₃ solutions on (Ga₁₋ₓZnₓ)(N₁₋ₓOₓ). Reaction conditions: catalyst, 0.10 g; 50 mM AgNO₃ aqueous solution, 140 mL; light source, 300 W Xe lamp (300 nm < λ < 500 nm).