**RESEARCH QUESTION:**
Can unique additively manufactured composite structures show increased decomposition of a particular compound of interest (COI)?

**BACKGROUND & MOTIVATION:**
- This project proposes a novel way to decompose harmful gas pollutants into a valuable source of green energy.
- The COI is a toxic gas that can be produced naturally and in industrial processing\(^1\).
- Photocatalysis can help manage the particular COI focused on in this study\(^2\).

**CATALYST MANUFACTURING:**
- 3 catalytic structure types created:
  - base catalyst (PC 1)
  - modified catalysts (PC 2, PC 3)
- Ink prepared using 95 wt% active material
- Rheological properties established for smooth flow
- Printed by a direct ink writing (DIW) process and CAD assistance

**REACTION SETUP:**
- Volumetric flow rate, temperature established via gas generator
- Flow through bypass for initial concentration reading
- Valve switches flow to reactor for experimental data collection
- Effluent gas analyzed using digital gas analyzer

**RESULTS AND DISCUSSION**
- Background studies identified potential losses to reactor
- Empty reactor tests indicate no photolytic decomposition

**ANALYSIS:**
**Quantifying Potential Decomposition**
- Consistent catalyst formulation establishes dependability in data comparison
- Background adsorption tests completed
- Comparative data between PC 1 and modified PCs 2 & 3 to show enhanced performance
- Concentration changes in COI and gaseous byproducts monitored

**General decomposition mechanism using a photocatalyst\(^3\)**
\[
\text{PC} + \text{hv} \rightarrow \text{PC} \left( e^- + h^+ \right) \\
\text{COI} + 2 \text{h}^+ \rightarrow X + 2 \ Y^* \\
2 \ Y^* + 2 \ e^- \rightarrow Y
\]

**REFERENCES:**

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**Figure 1.** Schematic for 3D printing via DIW process.

**Figure 2.** Reactor and data analysis setup for H\(_2\)S flow through 3D-printed monolithic structures.

**Graphs:**
- Dark Adsorption
- Dark and Light Tests