**Socratic Method Evaluation Form**

In this paper, we apply the Mixed Socratic Prompting Approach to a range of problems in chemistry and materials science, developing a structured methodology to enhance LLM reasoning through Socratic inquiry. This framework is designed to evaluate the performance of the Socratic Prompting Approach by comparing it with regular LLM reasoning. It is structured to help you track and assess LLM performance across different approaches. Please complete the provided sections accordingly.

Name, Surname: Mustafa Unal

E-mail: munal@anl.gov

Field: Crystal Growth and Radiation Detectors

Are you the expert on the field of question? Yes No

Does this prompt directly relate with your active research area? Yes No

1. Go to **ARGO** and select **Custom Task Type.**
2. **Write your prompt in a conventional, direct-answer manner.**

Prompt:

Can you summarize how to reveal dislocations on SiC wafers to perform dislocation density analysis?

Add follow up prompts below:

Follow-up 1:

Which etching solution is better to reveal dislocations on different crystal orientations?

Follow-up 2:

why chromic acid and phosphoric acid did not adopted on SiC etching process? and why are you suggesting?

Follow-up 3:

Why Consider Chromic and Phosphoric Acids?

Do you have more follow-up prompts? Yes No

What is the exported file name? SiC – Traditional LLM.txt

1. **Evaluate the performance of conventional approach.**

|  |  |
| --- | --- |
| Clarity | 3 |
| Depth of reasoning | 2 |
| Hypothesis refinement | 1 |
| Novelty of insights | 2 |
| Consistency | 1 |
| Applicability to real problems | 2 |
| Logical Coherence | 2 |
| Correctness of conclusions | 1 |
| Self-correction & iteration | 1 |
| Overall effectiveness | 2 |

1. **Enter observations and comments about conventional approach.**

Mentioned in the assessment document.

1. Start a new chat on ARGO, and switch to Socratic prompting. Develop a reasoning flow for your problem. Refer the page 17*,* ***Socratic Questioning & Chain-of-Thought Prompting*** section in the paper. Use **Figure 2 & Tables 3 & 4** to select Socratic principles.
2. Did you used same prompt at the beginning? Yes No
3. Did you use same follow up prompts? Yes No

If your answer is no, please fill the boxes below.

Follow-up 1:

What are the key characteristics of the etchants used for revealing dislocations in SiC, and how do they differ from those used for other semiconductor materials? What alternative methods could be considered if etching proves ineffective?

Follow-up 2:

Click or tap here to enter text.

Follow-up 3:

Click or tap here to enter text.

Do you have more follow-up prompts? Yes No

What is the exported file name? SiC – Socratic Approach.txt

1. **Evaluate the performance of Socratic Prompting approach.**

|  |  |
| --- | --- |
| Clarity | 4 |
| Depth of reasoning | 4 |
| Hypothesis refinement | 5 |
| Novelty of insights | 4 |
| Consistency | 4 |
| Applicability to real problems | 4 |
| Logical Coherence | 3 |
| Correctness of conclusions | 3 |
| Self-correction & iteration | 4 |
| Overall effectiveness | 4 |

1. **Enter observations and comments about Socratic Prompting approach.**

Mentioned in the assessment document.

1. **Analysis of results from an expert point of view.**

Mentioned in the assessment document.

1. **Evaluate the performance of Socratic and non-Socratic responses. Which one provides accurate and reliable responses? Why?**

Mentioned in the assessment document.

1. **What are the limitations and possible improvements?**

Mentioned in the assessment document.