

The Refractory Predictor 5000

A User Manual for Predicting Material Properties

1. So, What is This Thing?

Welcome! You've unzipped a powerful tool. In simple terms, this is a **"Crystal Ball" for materials science**.

You provide a "recipe" for a Magnesia-Carbon (MgO-C) material, and this tool uses a trained Artificial Intelligence (AI) model to **predict 8 of its important physical properties**, like how strong or dense it will be. This saves a lot of time and effort in the lab!

2. Before You Begin: The One-Time Setup

To use this tool, your computer needs a couple of things first. You only have to do this once!

Step 2.1: Install Python

This whole tool is written in a language called Python. If you don't have it, you'll need to install it.

1. Go to the official Python website: <https://www.python.org/downloads/>
2. Click the big "Download Python" button.

Run the installer. **IMPORTANT:** On the first screen of the installer, make sure to check the box at the bottom that says **"Add Python to PATH"**. This is a critical step!

Step 2.2: Open Your Computer's "Terminal"

This is a program that lets you type commands directly to your computer. It might look intimidating, but you only need two commands!

- **On Windows:** Click the Start Menu and type cmd or Command Prompt, then press Enter.
- **On Mac:** Open Launchpad or Spotlight Search and type Terminal, then press Enter.

Step 2.3: Navigate to the Project Folder

Now, you need to tell the terminal where you unzipped the project folder. You'll use the cd (Change Directory) command.

1. Find the path to your project folder. (On Windows, you can right-click the folder's address bar and "Copy address as text").
2. In the terminal, type cd, then a space, then paste the path to your folder and press Enter. It should look something like this:
3. `cd C:\Users\YourName\Downloads\MgO-C-Project`

Step 2.4: Install the Required Tools

Finally, run this one command in the terminal. It automatically downloads and installs the special tools our script needs to work.

```
pip install pandas scikit-learn joblib matplotlib seaborn
```

Press Enter and wait for it to finish. You are now ready to predict!

3. Let's Predict! (Running the Script)

This is the easy part. You can do this every time you want a new prediction.

Step 3.1: Run the Prediction Script

In the same terminal (that is still inside your project folder), type the following command and press Enter:

```
python run_prediction.py
```

Step 3.2: Choose Your Adventure!

The script will ask you how you want to provide the material's "recipe":

- **If you choose 1 for Manual Entry:** The script will ask you questions one by one. Just type the value for each ingredient (e.g., graphite wt %) and press Enter.
- **If you choose 2 to Load a File:** The script will ask for the path to your data file (CSV or Excel). Just drag and drop the file into the terminal window, and it will paste the full path for you! Then press Enter.

4. Understanding the Results

After you provide the data, the AI model will run. You'll see the results in two places:

1. **On Your Screen:** A neat table will be printed directly in the terminal, showing you the 8 predicted properties.
2. **In a CSV File:** A new file named **prediction_results.csv** will appear in your project folder. You can open this file with Microsoft Excel to see, save, and share your results!

5. Help! Something Went Wrong!

Don't worry, here are some common issues:

- **Error: 'python' is not recognized...** This usually means Python wasn't installed correctly. Try reinstalling it and remember to check the "**Add Python to PATH**" box!
- **Error: FileNotFoundError** This means the script couldn't find the file you specified. Double-check that you typed the path correctly or that the file is in the right place.
- **Error: Missing the following required columns...** This means the Excel or CSV file you provided doesn't have the correct column headers that the model needs to understand the data. Make sure your file's columns match the ones in the provided Dataset...csv file.