

User Guide: Materials Intelligence Platform

Interactive Evaluation & Forecasting Dashboard

1. Introduction

This interactive platform is designed to explore, rank, and forecast magnetic materials by bridging physical performance data with critical sustainability metrics. Unlike static databases, this tool allows users to manipulate scoring models in real-time, enabling the discovery of materials that balance industrial efficiency (Scalability) with environmental responsibility (Sustainability).

2. Interface Navigation

The dashboard is organized into 5 interconnected Tabs. Adjustments made in early tabs (such as weights or thresholds) automatically propagate to the final 'Overall' score calculation.

Tab 1: Reliability

Evaluates the statistical confidence of the data associated with each material.

- **Concept:** The Reliability Score (RS) is derived from data confidence coefficients (C_1, C_2, C_3).
- **Weights Controls:** Adjust the relative importance (x_{rs}, y_{rs}, z_{rs}) for Temperature, Magnetization, and Coercivity reliability.
- **Action:** Click 'Recalculate Reliability Scores' to update the dataset based on your confidence preferences.

Tab 2: Performance

The core engine for filtering materials based on physical properties.

A. Quick Filters

Set absolute minimum requirements. Materials below these values are excluded from the results:

- **Temperature Threshold (K): Default min 350 K.**
- **Magnetization Threshold (T): Default min 0.4 T.**
- **Coercivity Threshold (T): Default min 0.4 T.**

B. Advanced Scoring Model

Expand the 'Model settings' toggle to customize how raw physical values are converted into scores (1-5).

- **Tier Configuration (SF):** Define the granularity (2 to 5 levels) for each property.
- **Thresholds:** Manually define the cut-off values for each score tier.
- **Auto-fill thresholds:** Click this to automatically calculate balanced thresholds based on the statistical quantiles of the current dataset.

Tab 3: Sustainability

Evaluates environmental footprint and supply chain risks.

- **Weighting (S1 - S10):** Assign importance (0.0 to 1.0) to 10 specific indicators. The sum must equal 1.
 - S2: CO2 Footprint (kg CO2 eq/kg)
 - S3: Energy Footprint (MJ/kg)
 - S4: Water Usage (l/kg)
 - S5/S6: Circularity (Footprints adjusted for recycling rates)
 - S7: HHI (Market Concentration / Geopolitical Risk)
 - S8: ESG Score (Environmental, Social, Governance)
 - S9: Supply Risk (Critical Raw Materials assessment)
 - S10: Companionality (Dependence on host metals)
- **External Analytics:** Includes a direct link to the 'GreeNano Analytics' app for Pareto visualizations.

Tab 4: Overall

The master ranking table that synthesizes all previous analyses.

- **Formula:** Overall Score (OS) = $RS^x \times PS^y \times SS^z$
- **Purpose:** Allows you to balance the trade-off between Data Reliability, Technical Performance, and Sustainability in the final decision.

Tab 5: Prevalence & Forecast

A predictive modeling tool that generates theoretical material compositions based on global elemental availability.

Workflow:

- **1. Prevalence Data:** View/Edit the calculated prevalence of elements based on the high-scoring materials in the database.
- **2. Template Selection:** Choose a crystal structure base (e.g., RE2Fe14B, Spinel, Hexaferrite, L10).
- **3. Prevalence Filters:** Set Min/Max prevalence to exclude overly rare or overly common elements from the variable sites.

- **4. Generate Material:** The algorithm fills the variable atomic sites of the template with the best-fitting elements and estimates a price (€/kg).

3. Data Sources

The intelligence displayed in this platform is derived from the integration of two primary databases:

- **NEMAD Database:** Magnetic Anisotropy Materials Database (DOI: 10.38/s41467-025-64458-z). Provides physical properties (Curie/Neel Temperature proxies, Saturation Magnetization).
- **Sustainability Database:** Proprietary dataset (Alexandre Nominé) containing LCA metrics, Critical Raw Materials (CRM) lists, and Supply Risk calculations.