Why is It Worth Using Professional Materials Databases in CAD/CAE Environments?

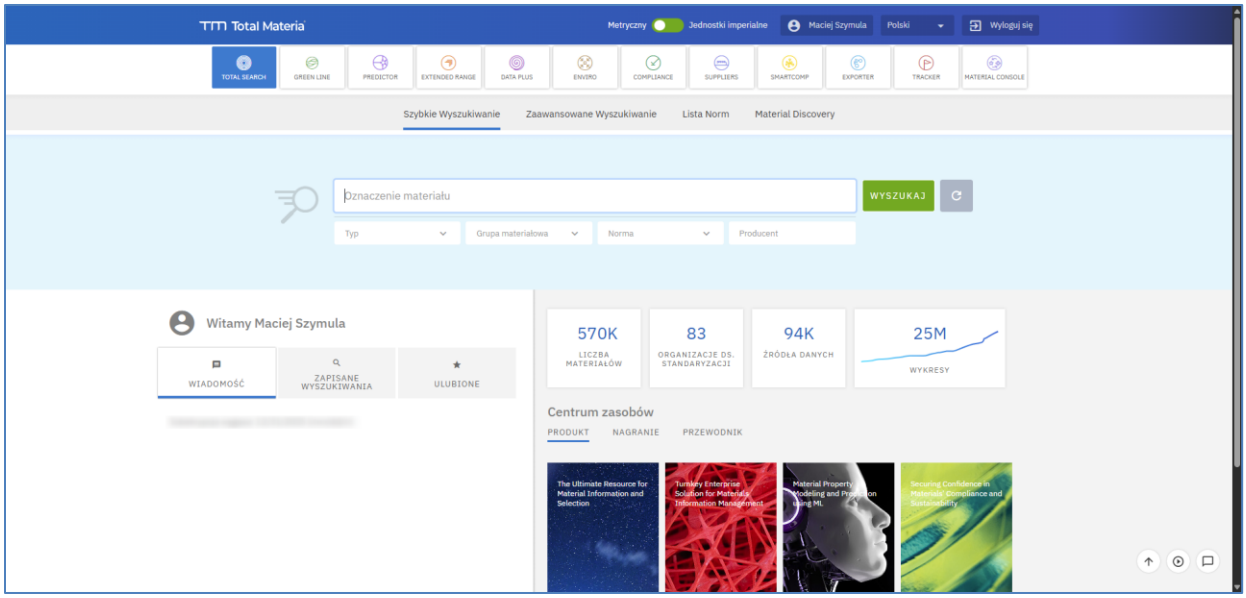
Accurate material data is the foundation of every engineering project, particularly in CAD/CAE environments. In Dassault Systèmes solutions such as **SOLIDWORKS** and **CATIA**, precise material properties are essential for correct geometric modeling and for preparing models for analysis.

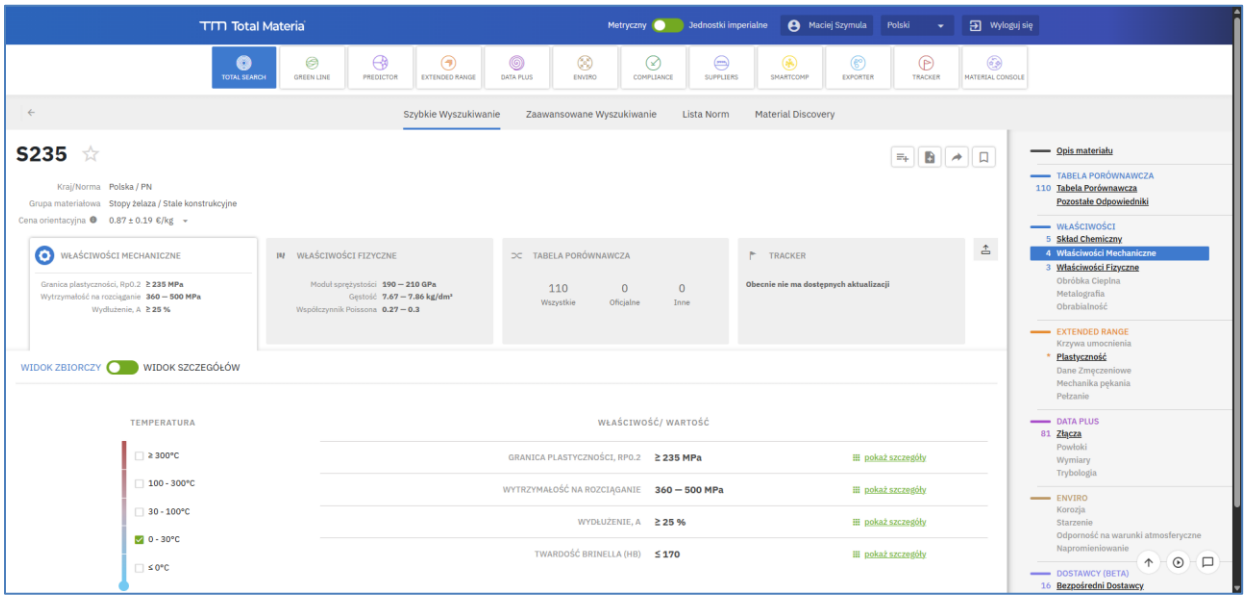
A lack of reliable, up-to-date, and comprehensive material data leads to serious issues:

- **Design errors:** Selecting the wrong material (e.g., due to outdated standards or incomplete data) may result in yielding, structural damage, or an incorrect component mass.
- **Inaccurate CAE simulations:** In numerical analysis tools such as SOLIDWORKS Simulation and 3DEXPERIENCE SIMULIA (based on Abaqus solvers), precise data is crucial. Advanced simulations (nonlinear, fatigue, dynamic) require comprehensive datasets such as stress–strain (σ–ε) curves and fatigue properties under varying conditions (temperature, loading). Using simplified or unverified data results in significant error, making the simulation unreliable and a waste of time.
- **Lack of consistency:** Various teams or departments (CAD, Analysis, Procurement) may use different, inconsistent data sources.

Total Materia – The Ideal Solution

Total Materia is the **world's leading material information platform** and the largest materials database, **containing over 570,000 metallic and non-metallic materials** and **more than 25 million property records**. It provides verified, reference-grade, monthly updated data—something unattainable when relying on traditional sources (books, websites, internal measurements). And all of this without ever leaving your desk.





Key Features of Total Materia for CAD/CAE Engineers:

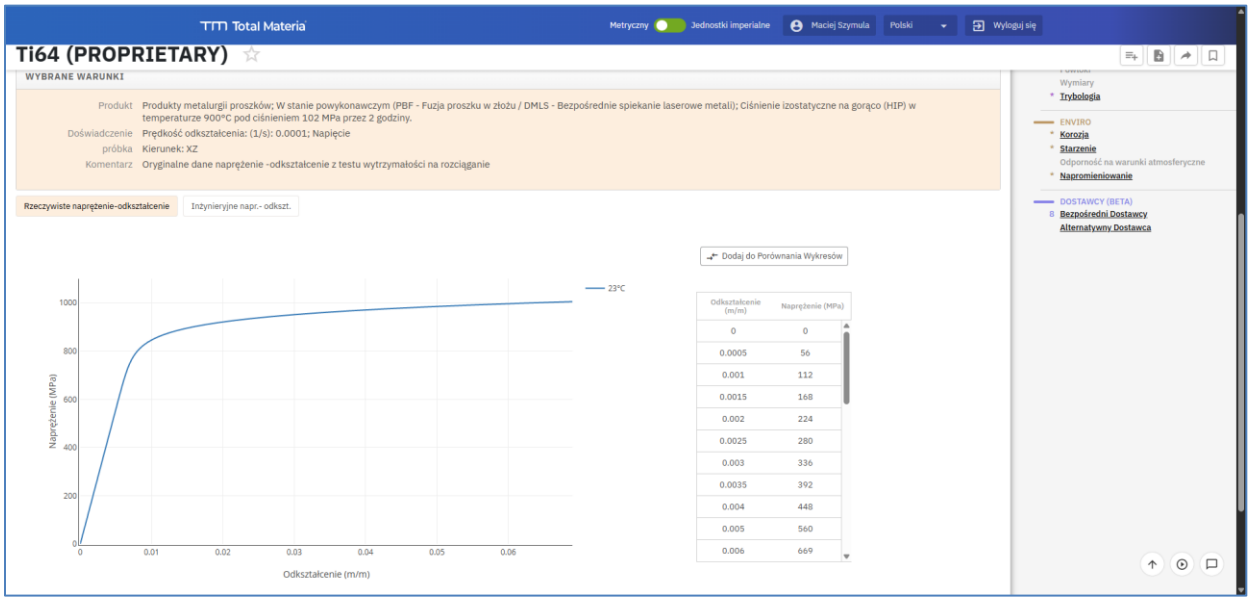
- **Comprehensive data:** Includes basic properties (mechanical, physical, chemical composition) as well as advanced CAE-ready data such as σ–ε curves, fatigue, creep, and fracture mechanics properties—essential for 3DEXPERIENCE SIMULIA and advanced SOLIDWORKS Simulation analyses.
- **Global standards and equivalents:** Offers international comparison tables (over 80 national standards). Patented algorithms allow rapid identification of equivalent materials worldwide—critical for global supply chains.
- **Compliance & Sustainability:** Modules like Green Line provide information on compliance with global regulations (e.g., REACH, RoHS) and material carbon footprint, supporting informed material selection.

- **Property prediction (Predictor):** Using machine learning (ML), this tool estimates missing material properties—an invaluable feature during early simulation stages or when working with new alloys

Implementing Material Data in CAD/CAE Systems

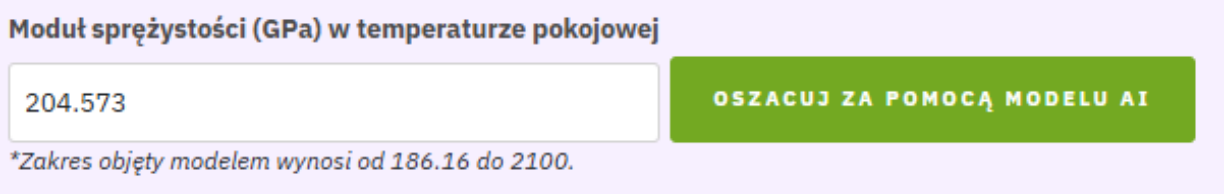
Total Materia enables seamless integration with key Dassault Systèmes platforms through export mechanisms or dedicated interfaces (Integrator):

- **Exporter:** Allows direct export of advanced material properties in formats ready for CAE solvers. Total Materia supports formats compatible with a broad range of tools, including Abaqus (the computational core of SIMULIA).
- **Integration with Dassault Systèmes tools:** Material data can be integrated into CAD/CAE systems (including SOLIDWORKS, CATIA, and PDM/PLM environments) in a structured manner. The Total Materia Integrator product establishes a single, approved "Single Source of Truth" for material data across the enterprise. This ensures that a SOLIDWORKS engineer uses the same validated properties as an analyst or a manufacturing engineer preparing process sheets and documentation.
- **Workflow optimization:** Instead of manually entering complex data (e.g., hundreds of σ–ε curve points or fatigue datasets), which is both time-consuming and error-prone, engineers can import ready-to-use material packages—saving time and increasing accuracy.



A Materials Revolution — Artificial Intelligence in Total Materia

In the era of digital transformation and rising demand for advanced simulations, traditional material databases are no longer sufficient. Total Materia addresses these challenges by integrating AI- and ML-based tools, which play a key role in optimizing workflows in SOLIDWORKS, CATIA, and SIMULIA environments.



Predictor — Predicting Material Properties

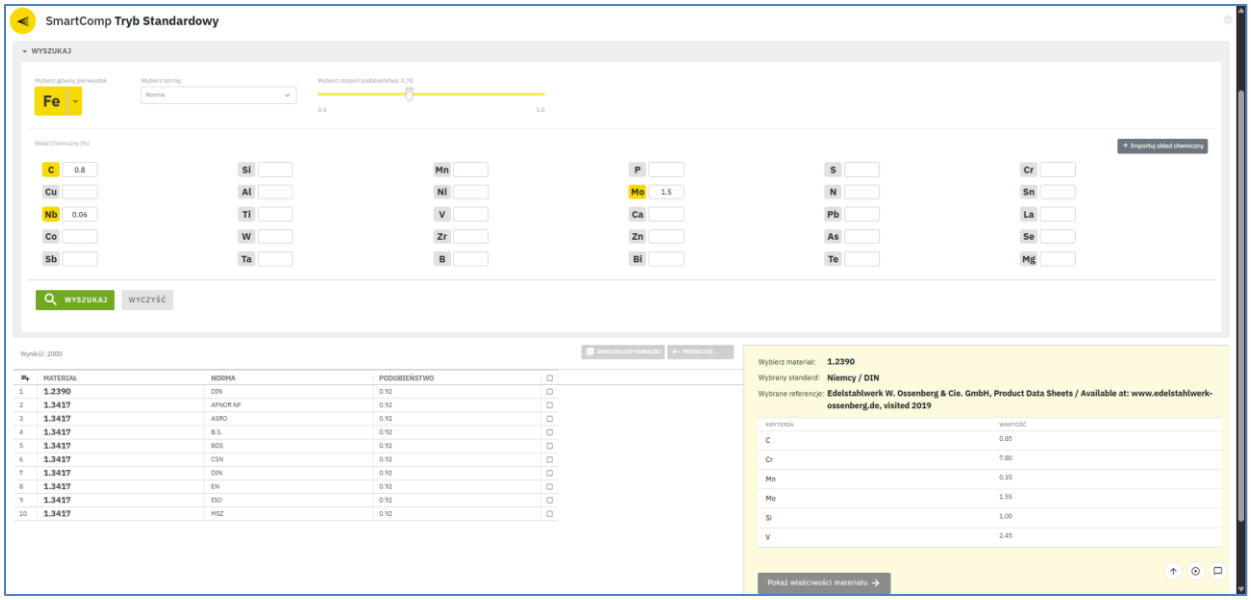
A cornerstone of AI in Total Materia is the Predictor module, which uses advanced machine-learning models trained on the world's largest collection of verified material data. Its main purpose is filling data gaps, a common engineering challenge:

- **Generating data for CAE simulations:** Advanced simulations in SIMULIA or SOLIDWORKS Simulation often require missing data such as stress–strain curves at non-standard temperatures or specific fatigue properties. Predictor can estimate these based on chemical composition and known parameters.
- **Preliminary material screening:** Engineers can quickly assess new or unconventional materials without costly, time-consuming laboratory testing. AI-generated data can be used immediately for preliminary simulations in CATIA or SOLIDWORKS.
- **Higher reliability in nonlinear simulations:** For advanced nonlinear analyses in SIMULIA, where precise curves and datasets are critical, Predictor delivers consistent, statistically justified properties, increasing simulation confidence.

SmartComp — Material Identification from Chemical Composition

Another major AI-driven tool in Total Materia is **SmartComp**, which solves the problem of identifying unknown or unmarked alloys—common in reverse engineering or failure analysis:

- **Rapid identification:** SmartComp analyzes the chemical composition (e.g., from spectrometer readings) and matches it to applicable standards and grades in the database.
- **Bridging laboratory testing with design:** After identifying the material, the engineer gains immediate access to all verified properties in Total Materia, which can then be imported into SOLIDWORKS or CATIA for design verification or failure analysis in SIMULIA.



AI in Total Materia transforms the work of designers and analysts by shifting the material-data workflow from passive searching to active modeling and prediction. This enables SIMULIA and SOLIDWORKS Simulation users to make faster, better-informed engineering decisions—even when faced with missing or incomplete data.

What Are the Benefits of Using Total Materia?

The most important benefit is a significant increase in CAE accuracy. Tools such as SOLIDWORKS Simulation and 3DEXPERIENCE SIMULIA are only as accurate as the data fed into them. Total Materia provides verified, advanced properties—precise curves, fatigue and creep data—often unavailable in standard libraries. This eliminates the need for simplifications, enabling more realistic simulations and therefore safer, optimized designs.

Integration with CAD/CAE dramatically shortens model preparation time. Engineers no longer need to spend hours searching standards, books, or internal documents, nor manually enter data into SIMULIA or SOLIDWORKS solvers. Export modules provide instant, ready-to-use data, allowing teams to focus on the physics rather than the data chase.

For large organizations, it is crucial that designers in CATIA or SOLIDWORKS and analysts in SIMULIA use the same validated material data. Total Materia—especially when combined with the Integrator module—creates a Single Source of Truth, ensuring that geometry designed in CATIA is verified in SIMULIA using the exact same, up-to-date material properties. This eliminates errors resulting from cross-department inconsistencies.

For companies operating globally, Total Materia is invaluable. It provides worldwide equivalency tables, enabling instant comparison of materials across national standards and suppliers. Designers can select local substitutes for foreign materials and quickly verify regulatory compliance (REACH, RoHS) via the Green Line module—critical for risk management and global supply-chain operations.

Why Total Materia is for You

- **TOTAL SEARCH:** Central module offering access to the world's largest database of mechanical, physical, and chemical properties for over 570,000 materials.
- **GREEN LINE:** Sustainability module providing regulatory compliance information (REACH, RoHS) and carbon-footprint estimates.
- **PREDICTOR:** AI-based machine-learning tool generating missing material properties for advanced numerical simulations.
- **EXTENDED RANGE:** Module offering advanced material datasets such as curves and fatigue data for nonlinear analyses in SIMULIA/Abaqus.
- **DATA PLUS:** Supplementary module providing additional technical subsets—joining data, lubricants, coolants, dimensions, coatings, in addition to detailed data on material resistance to corrosion, radiation, ageing and environmental exposure.
- **COMPLIANCE:** Quickly verifies material conformity with applicable standards and regulations, supporting risk and compliance management.
- **SUPPLIERS:** Connects material specifications with global suppliers, streamlining purchasing processes.
- **SMARTCOMP:** Patented algorithm identifying unknown metals based on chemical composition (e.g., spectrometric analysis), bridging lab testing with design data.
- **EXPORTER:** Enables instant, error-free export of selected material data in formats directly compatible with leading CAE solvers, including Abaqus (SIMULIA).
- **TRACKER:** Monthly notification service monitoring and reporting changes in standards or properties for tracked materials.
- **MATERIAL CONSOLE:** Tool for creating personalized material libraries, comparing properties, and managing material approval workflows.

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