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虎門科技股份有限公司

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Ansys Granta 碳足跡應用與產業成功案例分享

主講人: 李易軒 技術工程師

Presenter: Denzel Lee

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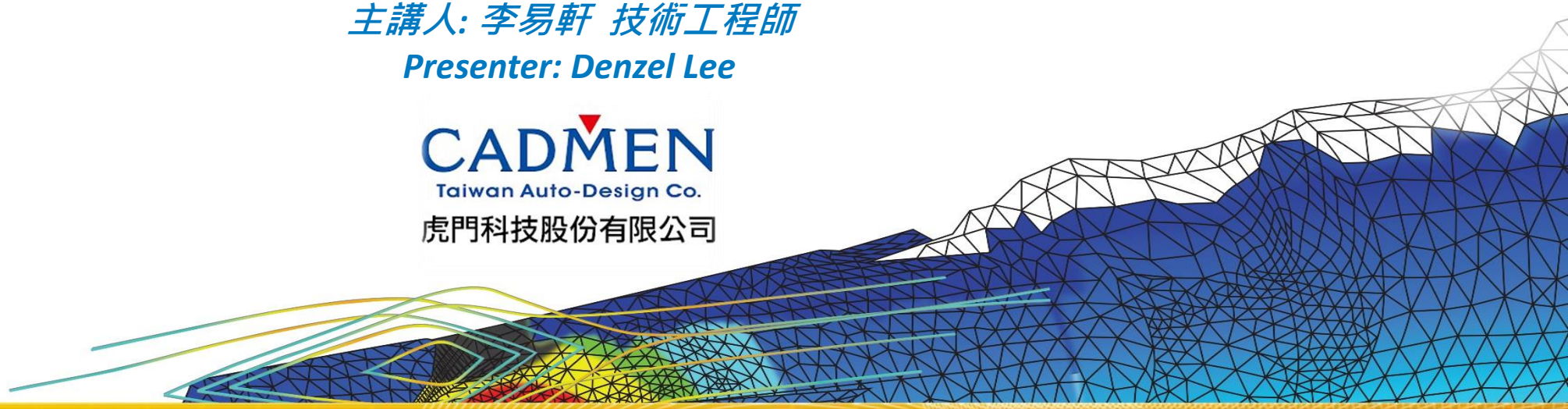
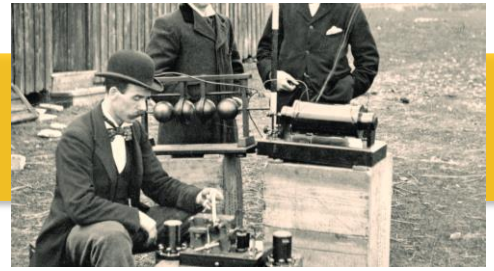
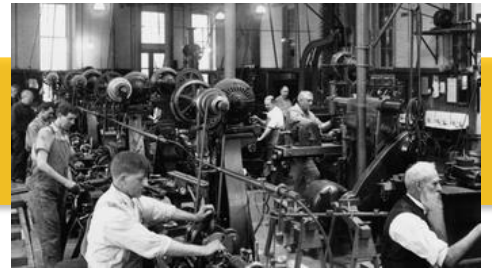
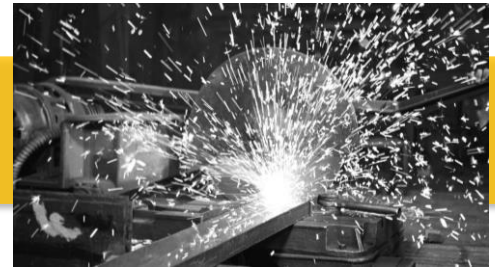
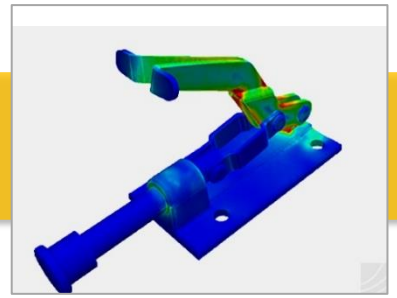
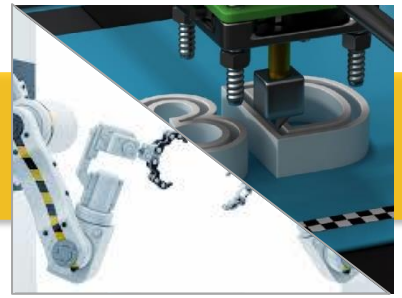


如何以電腦輔助產品設計？

當你製造一個產品，需要考慮四個因素

	形狀	功能	製造	材料
工業時代				
數位轉型	 CAD	 CAE	 CAM / 3D printing	材料資訊技術

為什麼材料資訊很重要?

成長 利潤 風險

了解材料行為以延長產品壽命

最大限度地減少由於受限制物質引起的監管風險

減少對環境的影響，增加市場佔有率

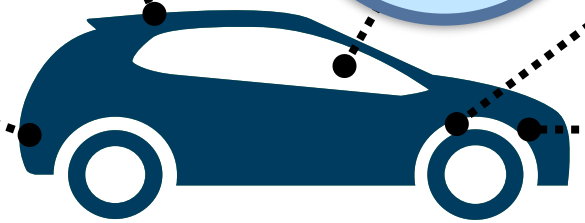
輕巧的複合材料可帶來競爭優勢

指定來自全球的正確材料

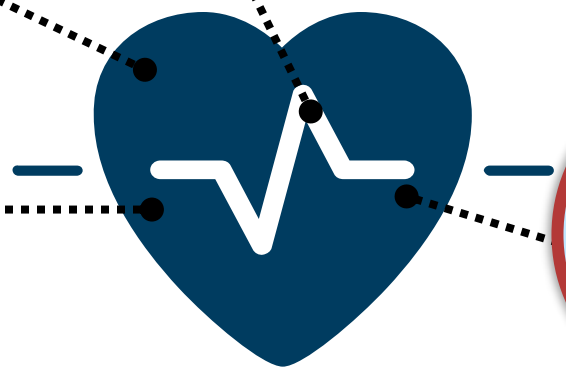
透過3D列印創新

通過替代材料使成本更低

輸入正確的數據以確保模擬的投報率



減少材料相關的保修問題或召回



避免危害人類健康

一般查找材料時...

材料使用議題

碳足跡、成本、重量、耐受性、個別機械材料性質需求 ...??

採購，CAE，製程...

內部專家

候選材料

提供討論以及專注於最有希望的解決方案與供應商

供應商

查網路

找顧問

GRANTA 的角色定位

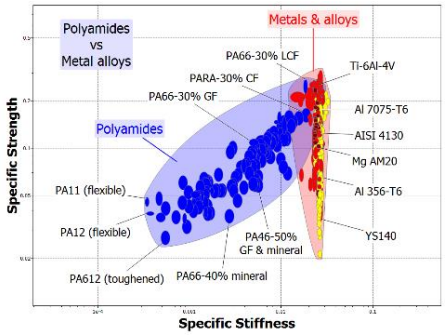
材料使用議題

內部專家

候選材料

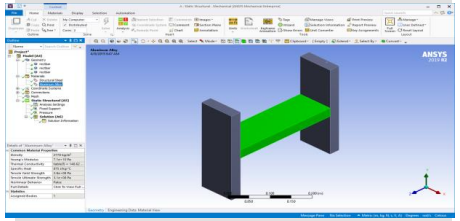
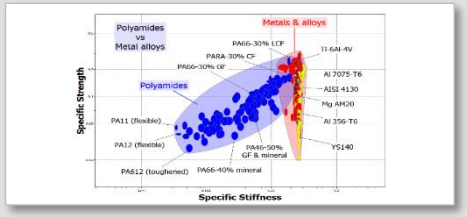
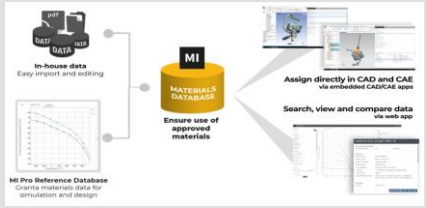
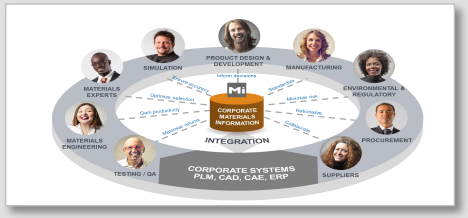
GRANTA
MATERIAL INTELLIGENCE

MaterialUniverse™

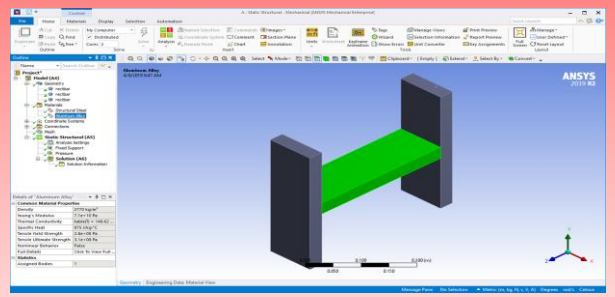


Increasing investment in solution

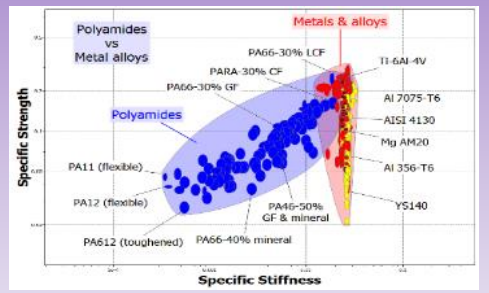
GRANTA 產品類別

	Materials Data for Simulation	GRANTA Selector	GRANTA MI Pro	GRANTA MI Enterprise
				
解決內容	**CAE工程師** 擴充模擬可以使用的材料選擇	**內部專家** 大數據最佳材料選擇	**企業** 設計及分析材料管理系統	**企業** 建立企業的材料資料庫
價值	專為工程模擬所打造且值得被信賴的材料庫	包羅萬象的材料資訊及大數據圖形搜尋工具提供高效率且智慧的材料選擇	專門針對企業內部研發及分析部門解決材料資訊一致性問題的資料庫	市場領先的企業級材料管理系統，統一企業內部各部門的材料資訊，確保各部門使用的是最新的材料資訊，提高管理效率降低人為失誤
產品內容	700種以上的材料並包含20種以上的材料性質	10,000種材料且包含100種特性的材料庫，並包含各種材料加工製程資訊供結果比較	可以與CAD及CAE軟體配合，管裡材料性質的資料庫系統	提供企業內部統一管理及使用材料資訊的工具，並允許與其他CAD、CAE、PLM軟體整合，外加10,000種以上的材料參考資訊

GRANTA 產品類別

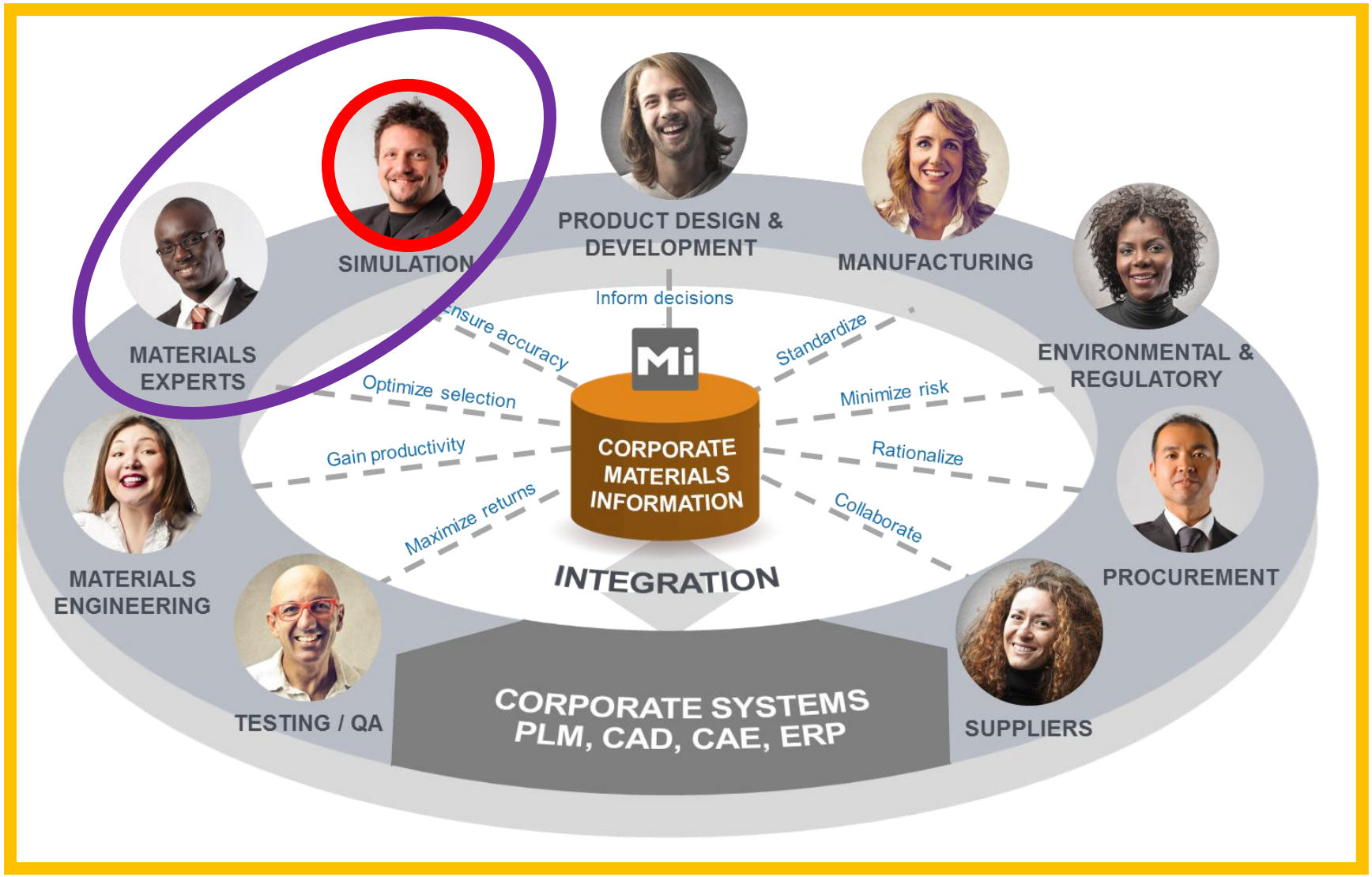


Materials Data for Simulation



Granta selector

Granta MI

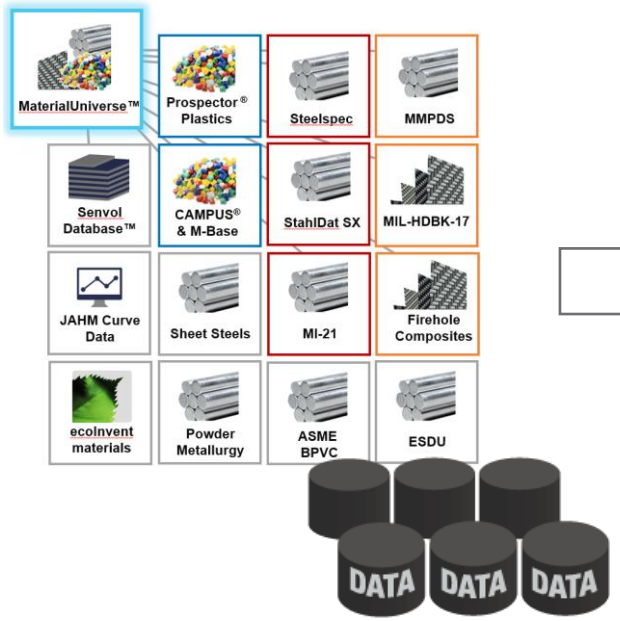


GRANTA Materials Data for Simulation

CADMEN Taiwan Auto-Design Co.

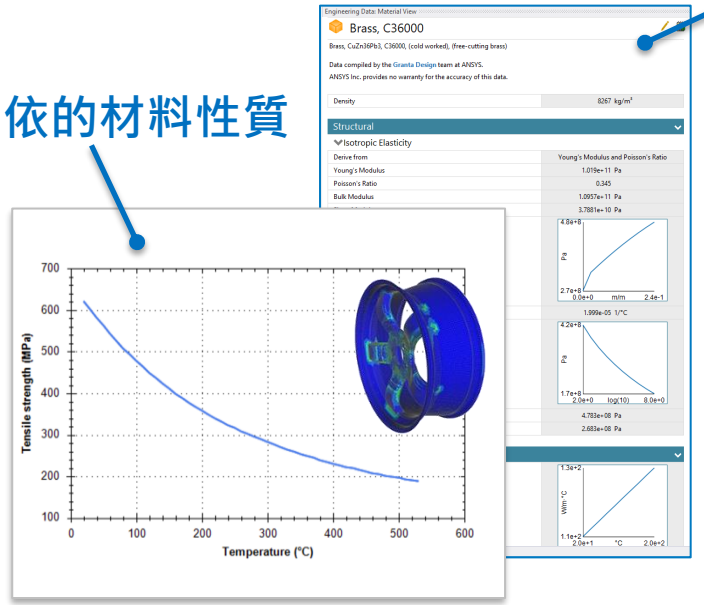
Ansys

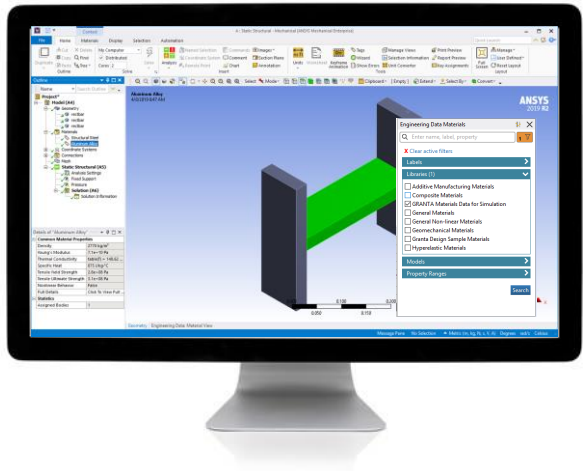
GRANTA Materials Data for Simulation



溫度相依的材料性質

廣泛的材料性質模型





由Granta橫跨各領域的材料庫組成

包含700多種可進行模擬的材料模型 (結構)

內嵌於ANSYS Mechanical, Fluent,Maxwell, Discovery介面

可靠的材料資料庫隨時準備好進行模擬

結構 700+ 材料種類 (持續增加中)

368 金屬

- ✓焊料 NEW in R3
- ✓鋼 (高, 中, 低合金鋼)
- ✓高、中、低碳鋼
- ✓鑄鐵
- ✓鍍層鋼
- ✓鎳合金
- ✓鐵合金
- ✓調質鋼及高強度合金
- ✓不鏽鋼(奧斯田鐵, 肥粒鐵,麻田散鐵, 析出硬化)
- ✓工具鋼
- ✓鋁合金
- ✓鈹合金
- ✓鉻合金
- ✓鈷合金
- ✓銅合金
- ✓鉛合金
- ✓錳合金
- ✓錫合金
- ✓鈦合金
- ✓鋅合金
- ✓貴重金屬合金
- ✓耐火合金
- ✓其他金屬

168 聚合物

熱塑性塑膠

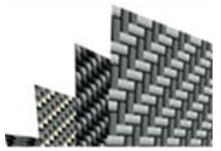
- ✓ 工程塑膠
  - ✓ PP (聚乙烯)
  - ✓ ABS, PS
  - ✓ PVC
  - ✓ PET, PBT
  - ✓ PMMA(壓克力)
  - ✓ POM (塑鋼)
  - ✓ PC
  - ✓ PA (尼龍)
  - ✓ PTFE (鐵氟龍)
  - ✓ 進階工程塑膠
    - ✓ PEEK
    - ✓ PEI, PAI, PI
    - ✓ PVDF
    - ✓ PSU, PESU, PPSU
    - ✓ PPS
    - ✓ LCP
  - ✓ 生質塑膠

熱固性塑膠

- ✓ Epoxy resins(環氧樹酯)
- ✓ Phenolics(酚醛樹酯)
- ✓ Polyesters(聚酯類)

彈性橡膠

- ✓ 熱塑性彈性體
- ✓ 熱固性彈性體



208 其他

流體 NEW in R3

- ✓ **氣體 (空氣, 氮氣,...)**
- ✓ **液體 (製冷劑, 水,...)**

陶瓷

- ✓工程陶瓷
- ✓一般陶瓷
- ✓ **半導體 NEW in R3**

木頭

- ✓工程木頭

複合材料

- ✓金屬母材複材
- ✓陶瓷母材複材

- ✓ **PCB 層壓板NEW in R3**

玻璃

- ✓工程玻璃

泡棉

- ✓彈性聚合泡棉
- ✓剛性聚合泡棉

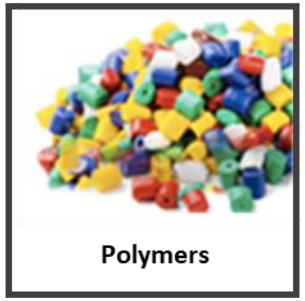
鐵磁性材料NEW in R3

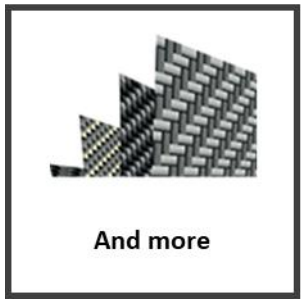
- ✓ **Hard magnets(永磁)**
- ✓ **Soft magnets(軟磁)**

蜂窩結構材料(honeycomb)

- ✓Expanded honeycomb
- ✓Extruded honeycomb

支援結構分析的材料模型 - Mechanical

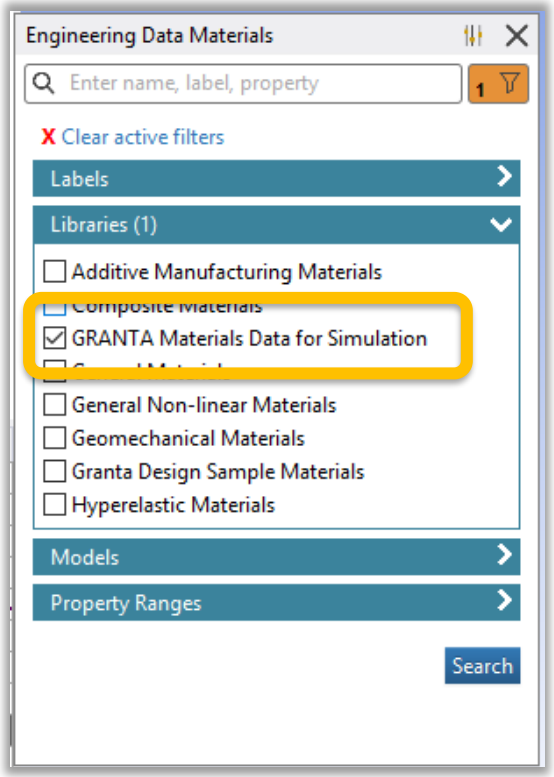




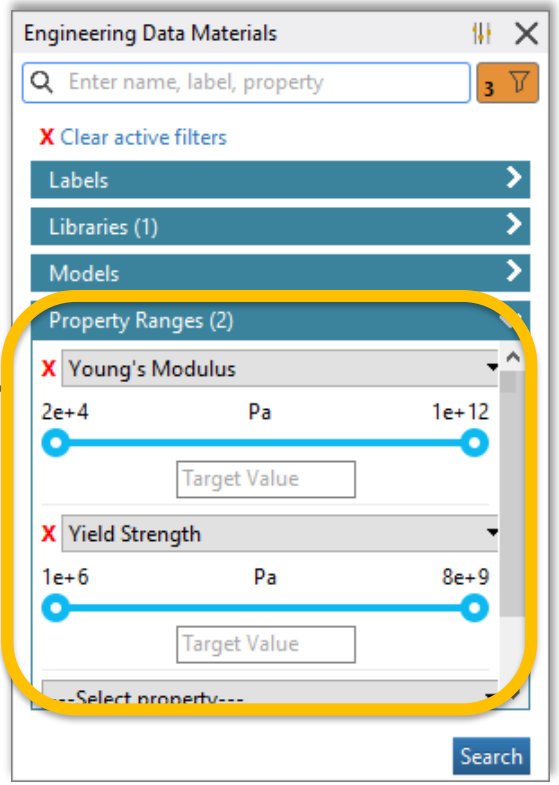
- 相關機械材料性質:
  - ✓ 等向線彈性材料 (楊世模數&蒲松比)
  - ✓ 失效 (拉伸降伏強度&抗拉強度)
  - ✓ 熱膨脹係數
  - ✓ 熱力學 (熱傳導係數&比熱)
  - ✓ 電力學 (電阻值)
- 部分材料包含以下溫度相依材料模型:
  - ✓ 熱膨脹係數
  - ✓ 電阻值
- 高階材料模型:
  - ✓ 疲勞曲線 (S-N with multiple mean ratio)
  - ✓ 應變率相依型材料 (Johnson-Cook, 5 example metals)
  - ✓ 超彈性聚合物 (Mooney-Rivlin)

MDS 即時獲取分析模型– ANSYS Mechanical 範例

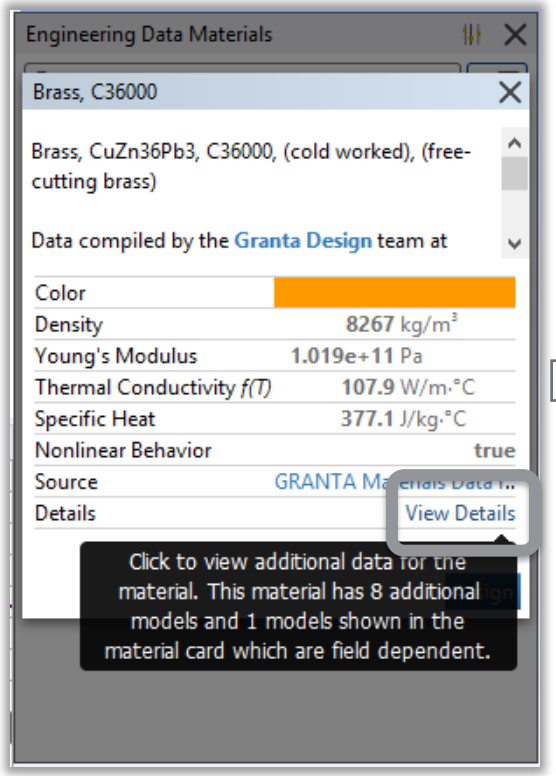
開啟資料庫



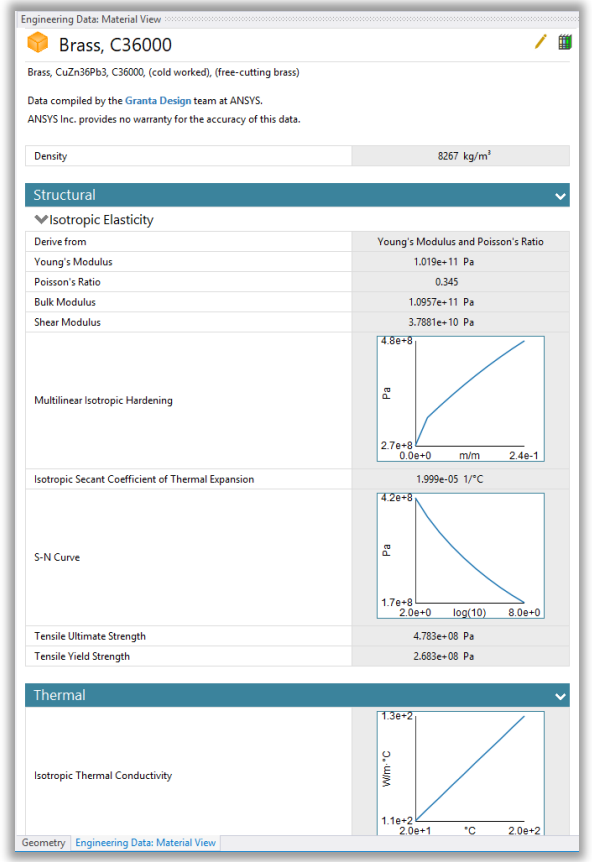
透過名稱、牌號或材料性質範圍收尋材料



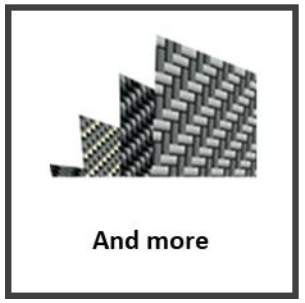
查看更多材料性質



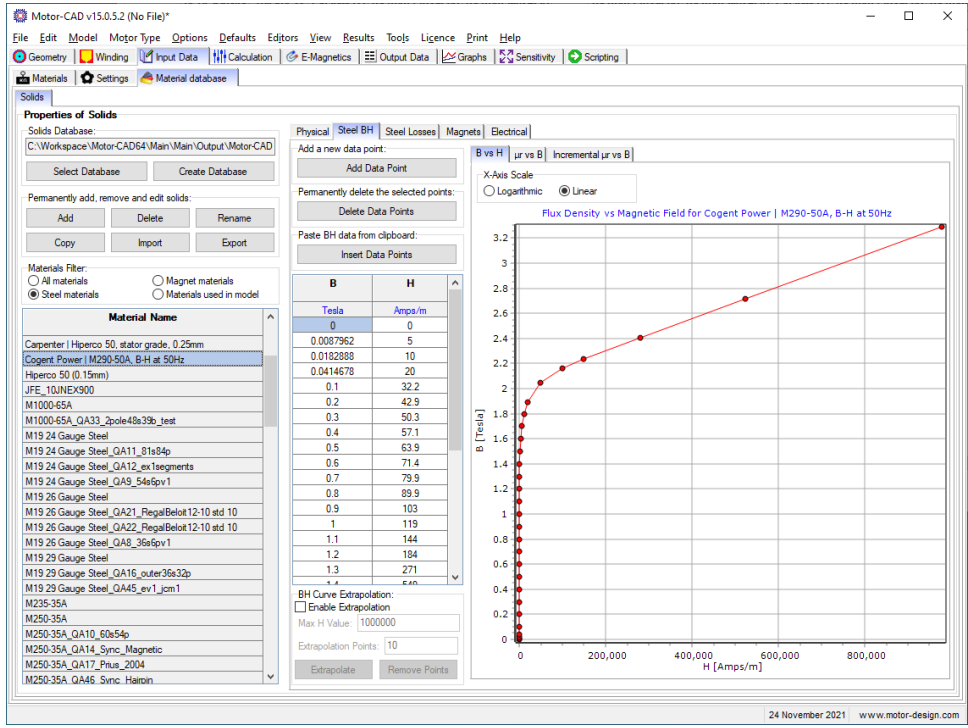
所有材料性質細節



支援低頻電磁場分析的材料模型 - Maxwell

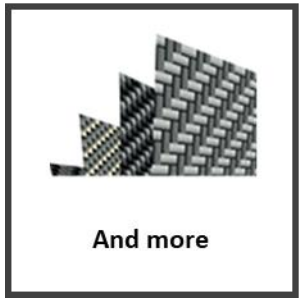


- 所有材料皆包含以下室溫下的材料性質
  - ✓ 等向線彈性材料 (陽氏模數&蒲松比)
  - ✓ 熱膨脹係數
  - ✓ 熱力學 (熱傳導係數&比熱)
- 多數材料包含以下電力學性質
  - ✓ 電導率 (部分材料包含溫度相依的性質)
  - ✓ 介電常數 (Dielectric constant)
  - ✓ 散逸因素 (Dissipation factor)
- 多數磁性材料包含以下磁力性質
  - ✓ 保磁力 (Coercivity)
  - ✓ 磁損 (約700種muti-frequency core loss curves)
  - ✓ 磁導率 (Permeability)
  - ✓ B-H curves (約600種 AC BH curves)
- 1900多種製造牌號的磁性材料
  - ✓ 皆含B-H curves
  - ✓ 多數含磁損



2022 R1新功能
支援MDS匯入Motor-CAD

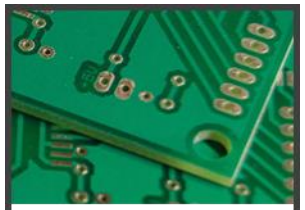
支援電子散熱分析的材料模型 - Icepak



- 穩態固體材料性質
  - ✓ 熱傳導係數*
- 暫態固體材料性質
  - ✓ 熱傳導係數
  - ✓ 比熱
  - ✓ 密度

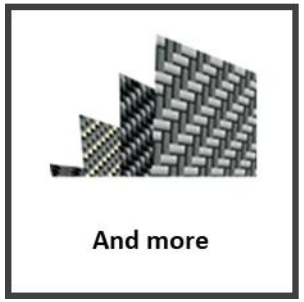
* 部分材料包含溫度相依的熱傳導係數

支援高頻電磁場分析的材料模型 – HFSS & SIwave

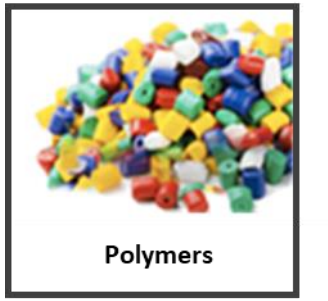


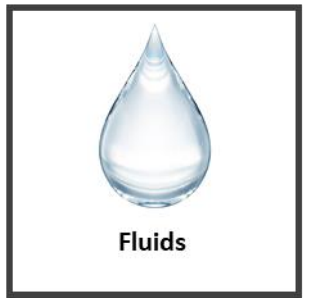
PCB Laminates

- 特定製造商所生產之PCB材料性質
  - ✓ 頻率相依的介電係數Dk (Frequency-dependent permittivity)
  - ✓ 頻率相依的介電損耗Df (Frequency-dependent loss tangent)
- 確保分析保有被動性及因果性



支援共軛熱傳的固體材料模型 – Fluent

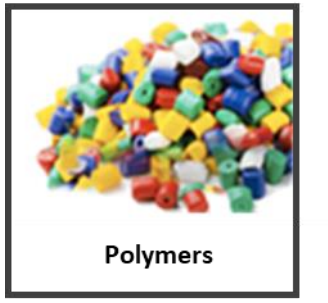


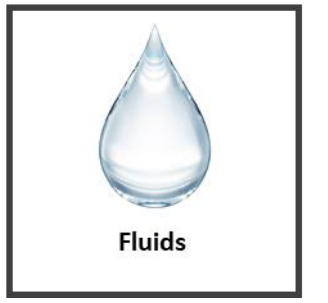


- 穩態及暫態材料性質
  - ✓ 熱傳導係數
  - ✓ 比熱
  - ✓ 密度
- 相關物理及電磁性質
  - ✓ 熱膨脹係數
  - ✓ 導電係數
  - ✓ 陽氏係數
  - ✓ 蒲松比
  - ✓ 磁導率

* 部分材料包含溫度相依的熱傳導係數

支援結構、熱傳及流場分析的材料模型 – Discovery





- 所有材料皆包含以下室溫下的材料性質
  - ✓ 等向線彈性材料 (楊世模數&蒲松比)
  - ✓ 失效 (拉伸降伏強度&抗拉強度)
  - ✓ 熱膨脹係數
  - ✓ 熱力學 (熱傳導係數&比熱)
- 流體
  - ✓ 密度
  - ✓ 黏性
  - ✓ 熱傳導係數
  - ✓ 比熱
  - ✓ 熱膨脹係數

MDS的價值

Easy access

1. 不用花費時間在查找資料
2. 可以快速的替換不同材料

Simulation-ready

1. 不只提供金屬材料的數據
2. 已經符合模擬的格式

Support for Multiphysics

1. 只需要一個License 就可以掛載到不同產品上

Data you can rely on

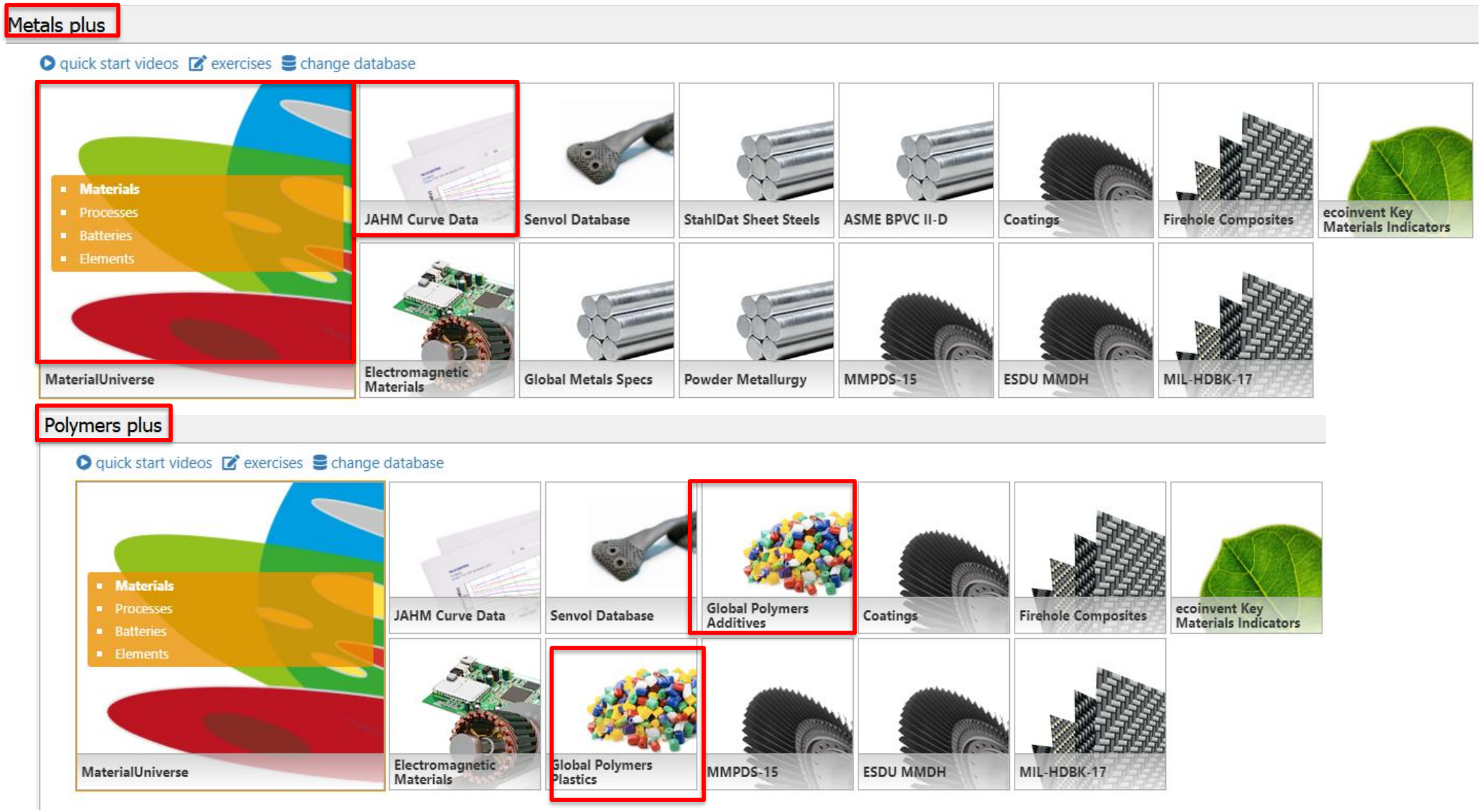
1. 經過Granta材料團隊認可

Granta selector

CADMEN Taiwan Auto-Design Co.

Ansys

Granta Selector 兩大主材料庫



Granta Selector 擴充材料庫

Core data – included in every license

- MaterialUniverse™
- JAHM Curve Data

Additional data series – purchased as collections

Metals

- ASM Alloy Finder
- StahlDat SX
- ASME BPVC
- StahlDat Sheet Steels
- Steelspec
- MI-21
- Powder Metallurgy

Global Metals

Polymers

- Prospector® Plastics
- M-Base Plastics

Composites

- MIL-HDBK-17
- Firehole Composites

Medical

- ASM Medical Materials

Aerospace

- MMPDS
- Coatings

Additive

- Senvol Database™

Standalone modules – purchase separately

- ESDU
- Eco

- ✓ Unique
- ✓ Comprehensive
- ✓ Linked

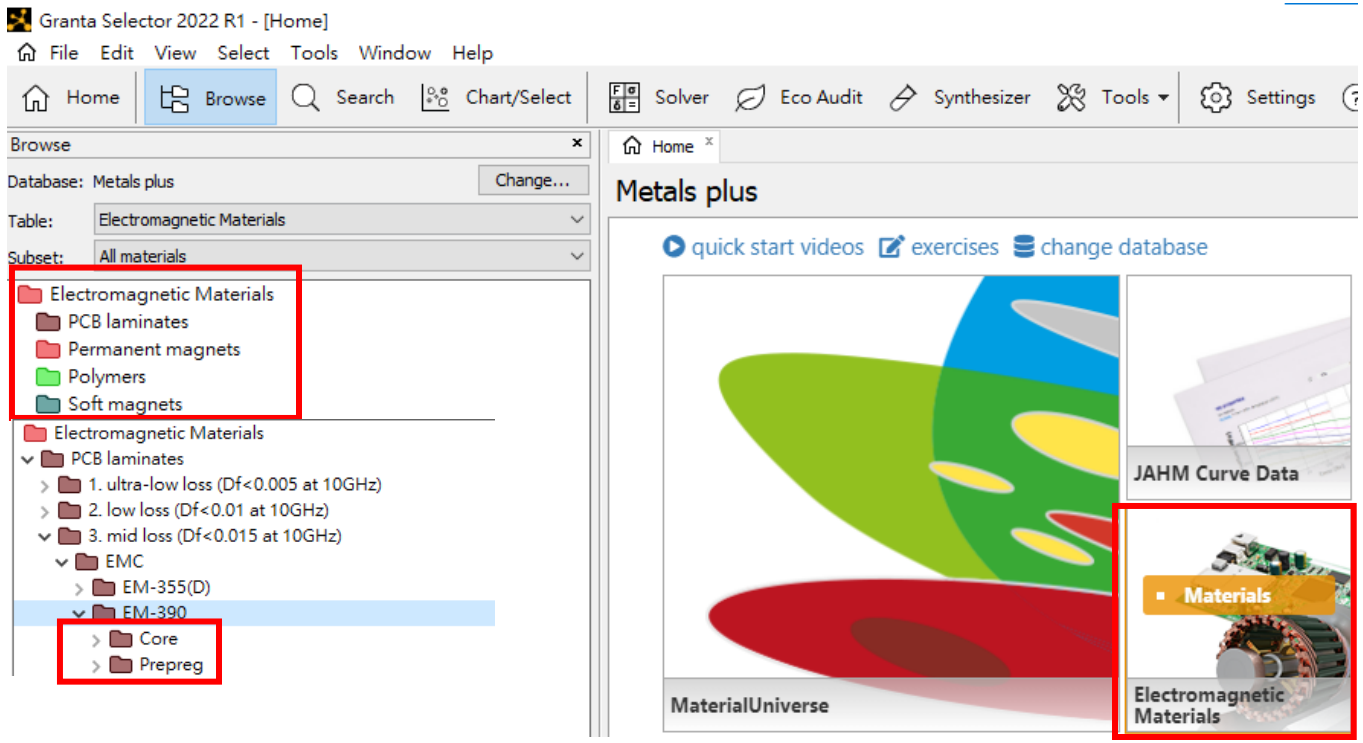
Key

- Generic data
- Design data
- Supplier data
- Standards, specs
- Test data
- Specialist
- G Compiled / maintained by ANSYS GRANTA
- www Online subscription resource, linked from GRANTA Selector

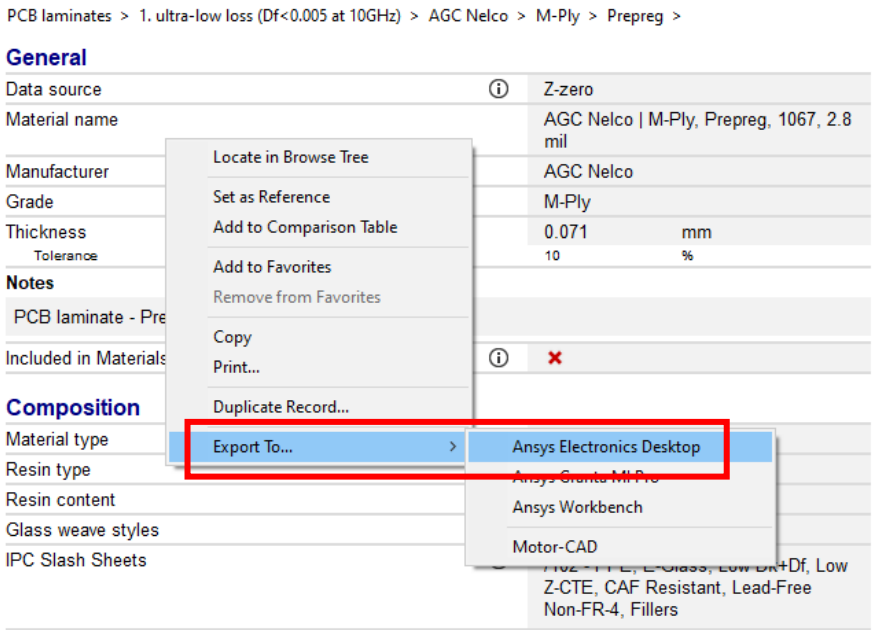
2022R1新功能
新增電磁專用材料

Granta Selector 擴充材料庫 – Electromagnetic Materials

- Granta Selector新增了8000種以上電磁專用材料，新增四種材料種類，包括常用的PCB介電材料(Prepreg & Core), Soft magnetic materials, Permanent magnets , EM- absorbing materials。
- 支援材料匯入Motor-CAD和AEDT使用。



2022R1新功能
新增電磁專用材料



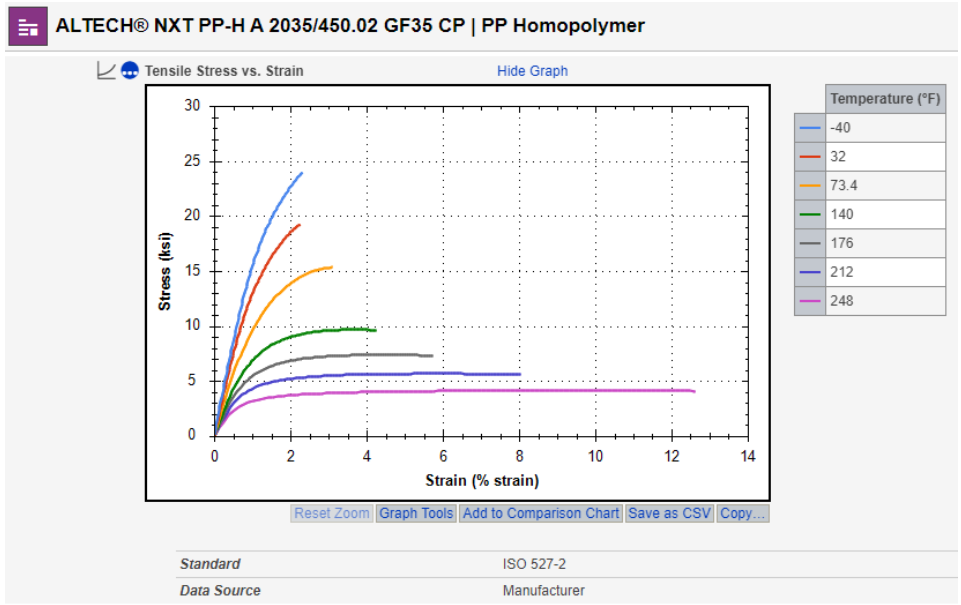
2022R1新功能
新增電磁場材料匯入AEDT和Motor-CAD

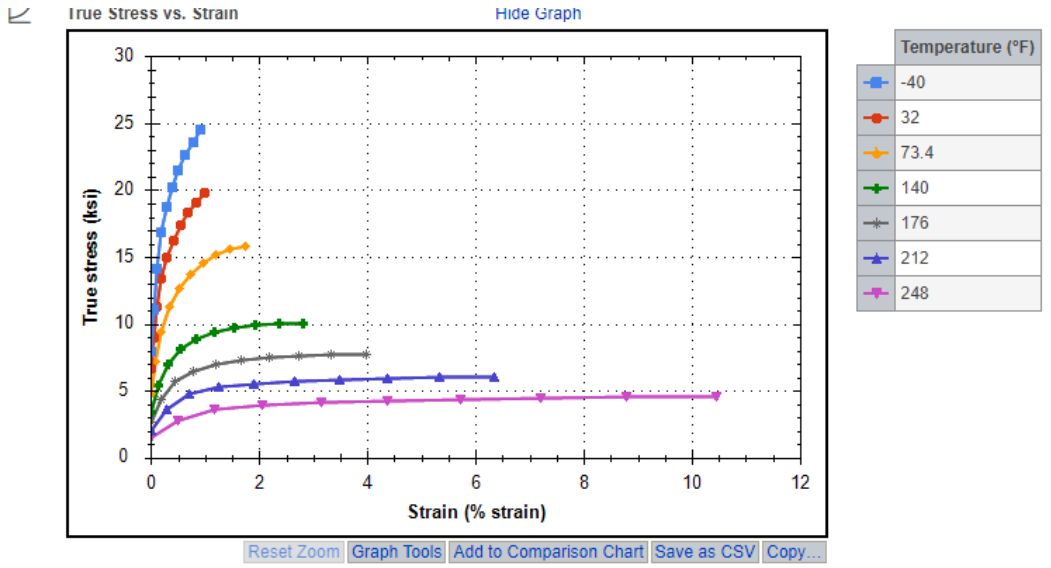
Granta Selector 擴充材料庫 - Electromagnetic Materials

- 電磁場材料的材料特性包含以下資訊:
  - 一般資訊(製造商，材料等級)
  - 樹脂類型，IPC斜線板，厚度（僅限PCB）
  - 密度（僅限磁鐵）
  - 機械材料性質
  - 熱性能 – 最大使用溫度、玻璃化轉變溫度、熱膨脹係數（僅限PCB）
  - 電導率/電阻率 (僅限磁鐵)
  - Frequency dependent properties – dielectric loss tangent (Df) vs frequency and relative permittivity (Dk) vs frequency (僅限非磁材料)
  - Magnetic properties – coercivity, remanence, B-H curve and core loss
  - Durability – time to decomposition at 260˚C and 288˚C, water absorption, CAF resistance (僅限PCB)

Granta Selector 擴充材料庫 - Polymers

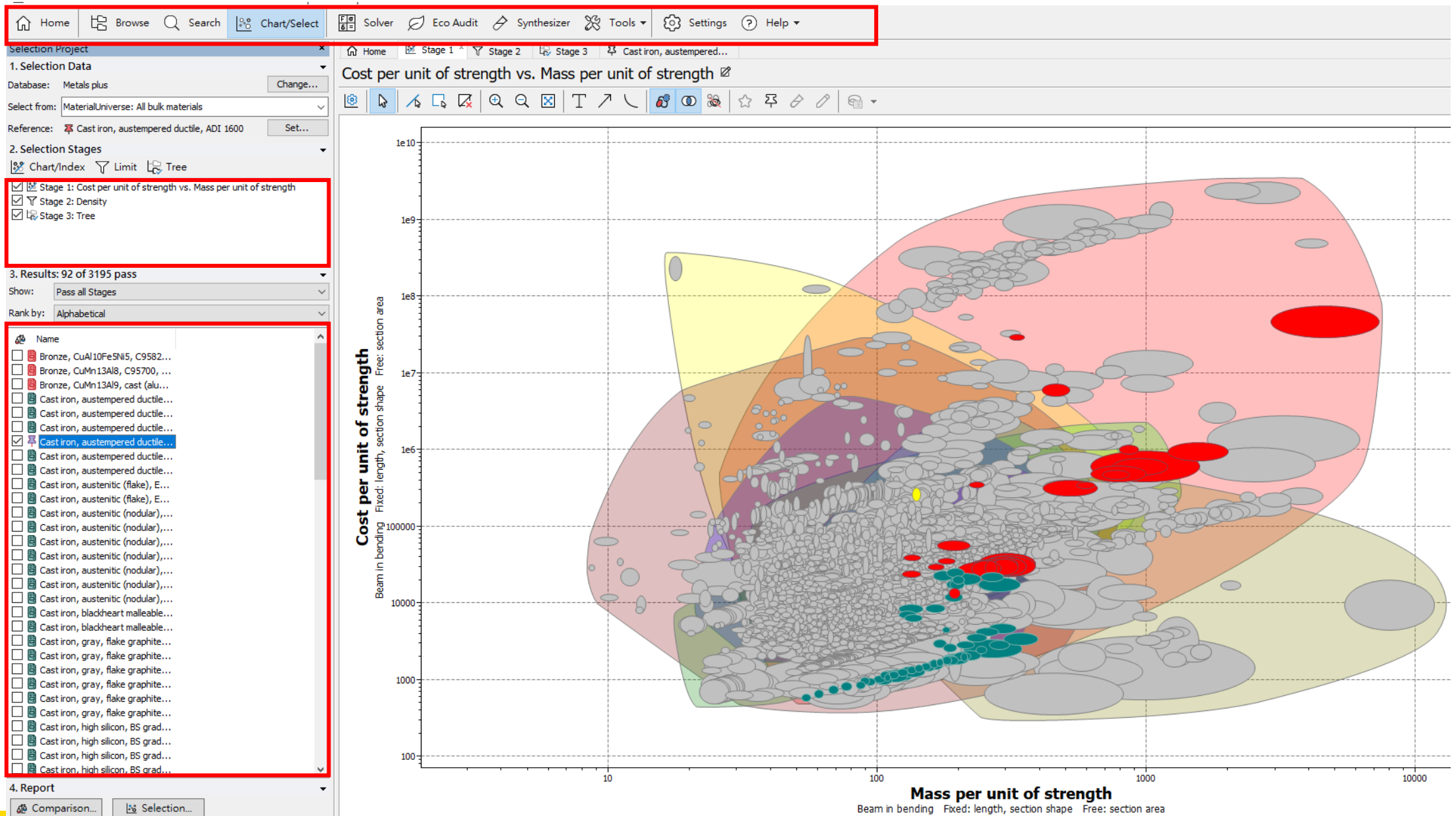
- 聚合物材料庫，記錄了105000種以上筆材料數據。
- 新增了非線性數據，包括拉伸應力-應變、拉伸模量-溫度、蠕變數據、比熱容-溫度、熱膨脹係數-溫度和熱導率-溫度...等關係圖。





2022R1新功能
聚合物-不同溫度所對應的應力與應變關係圖

Granta Selector 介面



Engineering Solver

:Untitled - Granta Selector 2022 R1 - [Product]

File Edit View Select Tools Window Help

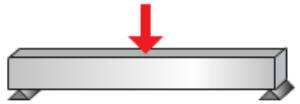
Home | Browse | Search | Chart/Select | Solver | Eco Audit | Synthesizer | Tools | Settings | Help

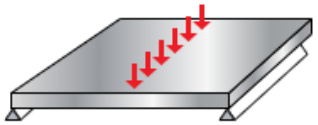
Select a situation:

The Engineering Solver allows you to convert engineering requirements into material properties.

Select a situation below and enter the details of the design. Use the resulting values in a Limit Stage to identify qualifying materials.


Tie in Tension


Beam in Bending


Panel in Bending

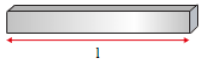

Shaft in Torsion


Column in Compression


Helical Spring

Engineering Solver

Beam in Bending | Change situation



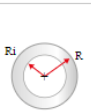
Estimates the minimum strength, stiffness and shape factor values required for a beam with the specified geometry and load conditions.

Assumptions:

- Material is homogeneous and exhibits the same stiffness in tension & compression
- The beam is nominally straight, with uniform cross section
- Beam is long in proportion to its depth. Minimum length/depth ratio varies as follows:
  - Metal beams with compact section = 8
  - Beams with relatively thin webs = 15
  - Rectangular timber beams = 24

Geometry

Cross-section:	Circle, hollow	
Radius (R):	25	mm
Inner radius (Ri):	20	mm
Length (l):	2	m



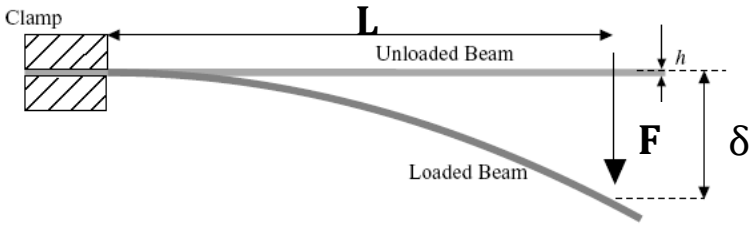
Design parameters

Load conditions: Cantilever, End load

Load:	1000	N
Safety factor:	1.5	
Maximum deflection:	50	mm

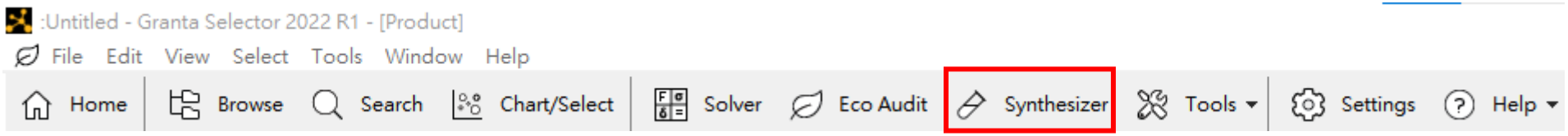
Results

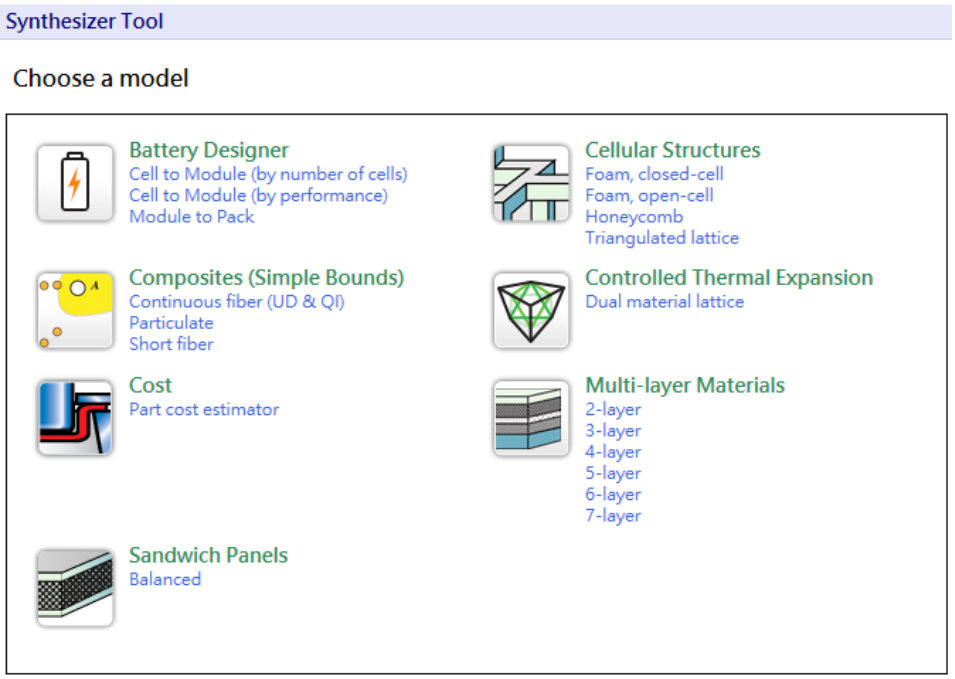
Young's modulus	Yield strength	Shape Factor
442 GPa	414 MPa	4.35

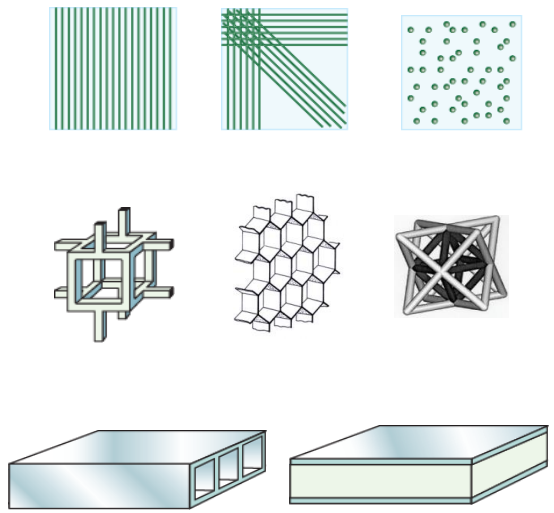


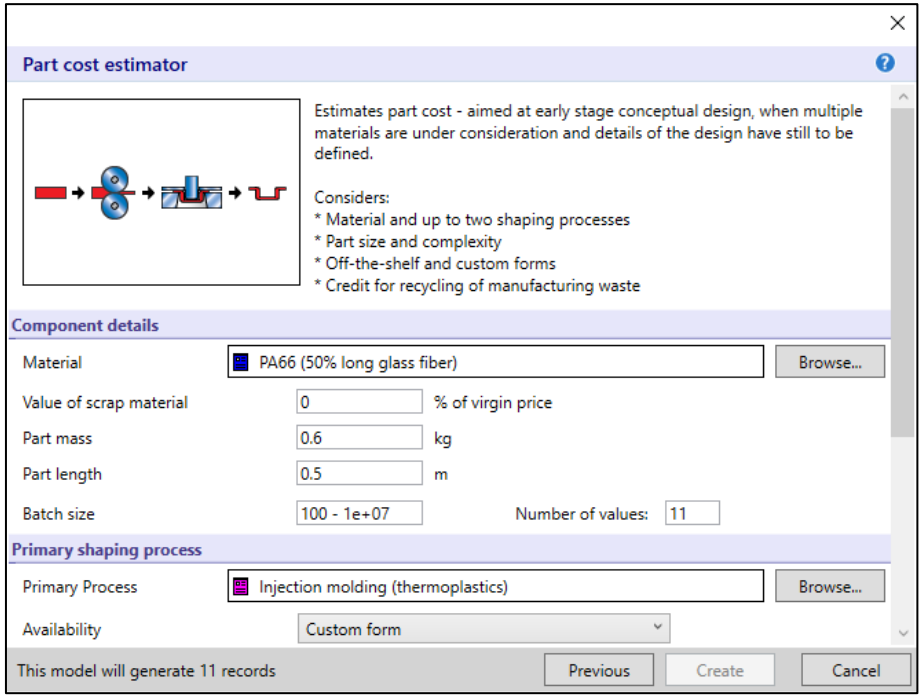
透過求解器了解如何選取材料

Synthesizer Tool









Synthesizer工具:
電池合成工具
複材
價錢評估工具

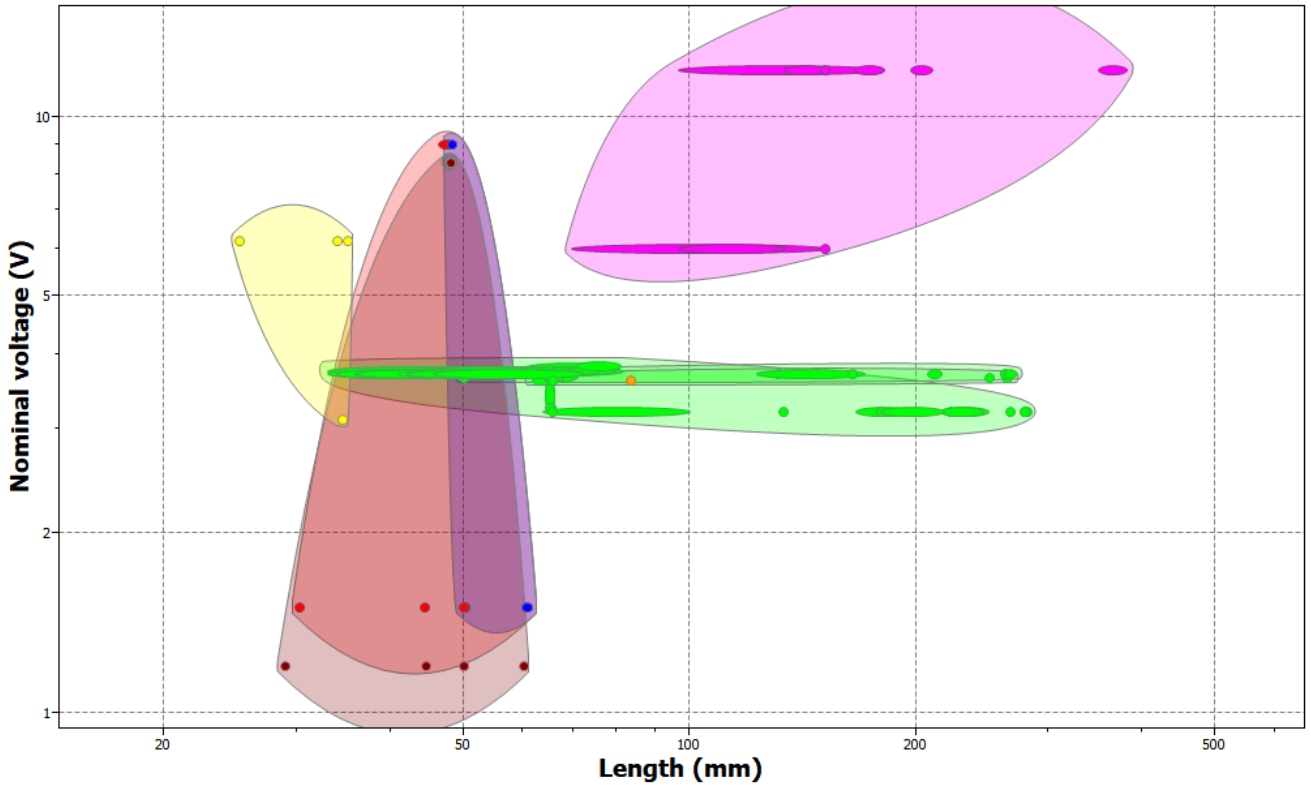
設計複材

價錢評估工具

Synthesizer Tool -Batter

Size			
Weight	ⓘ	996	g
Length	ⓘ	83.5	mm
Width		44.5	mm
Thickness		80	mm
Volume	ⓘ	2.97e5	mm^3
Module			
Number of cells in series		3	
Number of cells in parallel		1	
Nominal ratings			
Nominal capacity	ⓘ	697	mAh
Nominal voltage	ⓘ	3.6	V
Discharge			
Max (continuous) discharge current	ⓘ	12	A
Max discharge C-rate	ⓘ	17	C
Battery Module/Pack properties			
Actual C-rate	ⓘ	1.4	C
Actual discharge current	ⓘ	1	A
Discharge time	ⓘ	42	min
Percentage of max rate	ⓘ	8	%

This model will generate 9 records | Previous | Create | Cancel



Batter design tool 用來進行電池的設計，亦可用來比較不同電池(芯)的效能。

Eco Audit

碳足跡(Carbon Footprint)可被定義為與一項活動(Activity)或產品的整個生命週期過程所直接與間接產生的溫室氣體排放量。碳足跡從消費者端出發，破除所謂『有煙囪才有污染』的觀念。企業及產業溫室氣體的排放，一般是指製造部分相關的排放，但產品碳足跡排放尚須包含產品原物料的開採與製造、組裝、運輸，一直到使用及廢棄處理或回收時所產生的溫室氣體排放量。

Eco Audit Tool – Eco Audit

Product definition | Report

New | Open | Save | Compare with...

Product information

Name: PA66

Material, manufacture and end of life — 零件/材料/質量/製程/廢棄處理

Components

Qty.	Component name	Material	Recycled content	Mass (kg)	Primary process	Secondary process	% removed	End of life	% recovered
1	Beam	PA66 (60% glass fiber)	Virgin (0%)	2			0	Landfill	90
1	Coonecting rod	Aluminum, 5086, H32	40.0%	0.05			0	Recycle	90
2	Bushing	TPU(r) (molding)	Virgin (0%)	0.03	Polymer extrusion		0	Landfill	0
1				0			0	None	100

Joining and finishing — 鎖固

Name	Process	Amount	Unit
screw	Fasteners, small	8	
	Fasteners, large	0	

Transport — 運輸

Name	Transport type	Distance (km)
	32 tonne (4 axle) truck	250

Use — 使用

Product life: 10 Years

Country of use: World

Static mode

☐ Product uses the following energy:

Energy input and output: Electric to thermal

Power rating: 0 W

Usage: 0 days per year

Usage: 0 hours per day

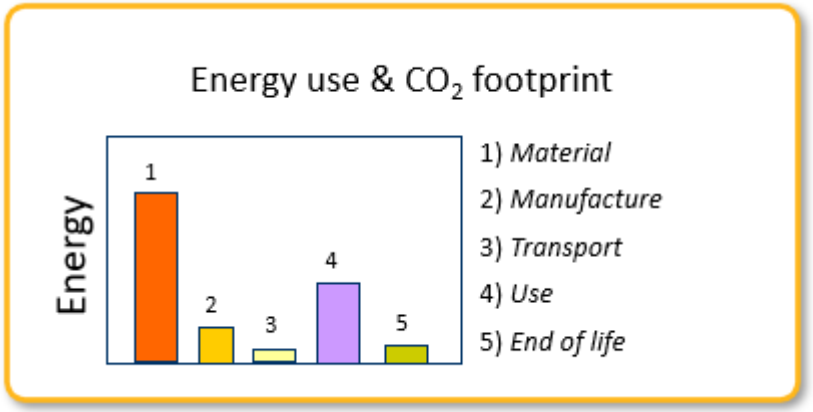
Mobile mode

☑ Product is part of or carried in a vehicle:

Fuel and mobility type: Diesel - family car

Usage: 200 days per year

Distance: 75 km per day



Questions, Comments, Feedback?

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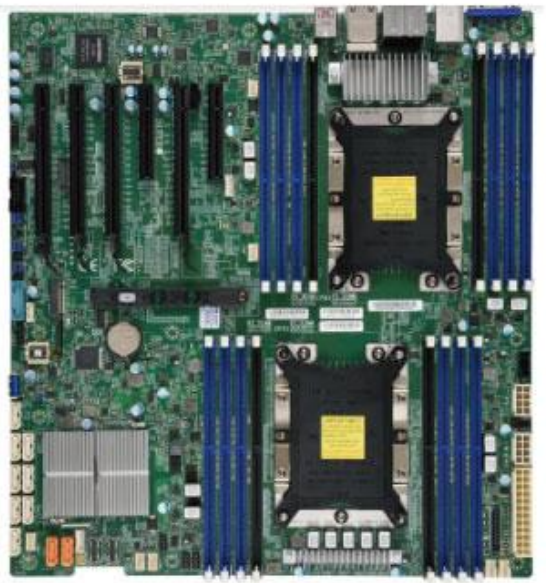
Ansys 2022/R1 Engineering What's Ahead.

新技術線上研討會

4/8 (五) 14:00-14:40	Ansys Motion & MAXWELL NVH 耦合技術應用 新技術線上研討會	黃國豐
4/8 (五) 15:00-15:40	Ansys nCode DesignLife 新技術線上研討會 (高溫疲勞和潛變分析應用)	鄒明嘉
4/8 (五) 16:00-17:00	Ansys Discovery 新技術線上研討會	陳姿秀/吳承澤



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