

How Continuum Blue uses CES Selector to save time and cost in plastics selection

At a web seminar hosted by Granta, Dr Mark Yeoman, of UK-based technology development consultancy Continuum Blue, spoke about minimizing risk when selecting or changing materials. He presented a case study showing how his company had used the CES Selector™ software to help a client to find a suitable plastic for a container for a new organic solvent range. He explained how it took just a few hours to identify candidate materials, reducing consultancy time from months to weeks, and thus considerably cutting the cost to the client. The chosen material matched the client's established production process and also resulted in cost savings.

How to reduce risk when selecting or changing materials

Gravitating away from established supply chains and preferred materials comes with inherent risk. During development, dangers include failure to achieve anticipated performance and the expense of an extended development time. Once a material reaches manufacture, you may discover it has issues—for example, plastics can often be subject to cracking or high distortion rates during processing, leading to high and costly scrap rates. Should a material fail in service, you could be left with increased maintenance/warranty returns, customer dissatisfaction, product recalls and, critically, damage to your brand reputation.

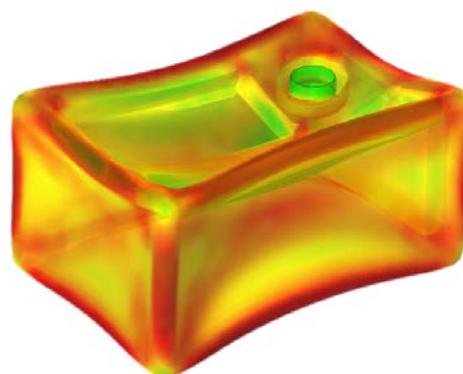
“In under two hours you can find an alternative solution that helps with material costs and reduces the carbon footprint.”

There are times, however, when the specification and qualification of a new material is essential, so how can you avoid these risks? Typically, this is achieved by evaluating multiple materials through extensive testing, modeling, characterization and prototype programs. This can be both time-consuming and expensive, but ultimately necessary. A report by Smithers Rapra¹, one of the world's largest independent investigators of failed plastic and rubber components and products, revealed 45% of failure was due to poor material selection and a misunderstanding of the performance specification.

Using CES Selector to identify candidate materials

In order to identify the most promising material candidates for your application, it's critical that you have access to a complete and comparable set of data that enables you to investigate and understand the performance of those materials in the early stages of design, and to identify any potential issues.

In the case of Continuum Blue, the challenge was to find a suitable container material that could house a new organic solvent range. Their client was using high density polyethylene (HDPE) for the containers and, while that is a robust and reliable material, it wasn't suitable for the design challenges presented by this particular solvent.



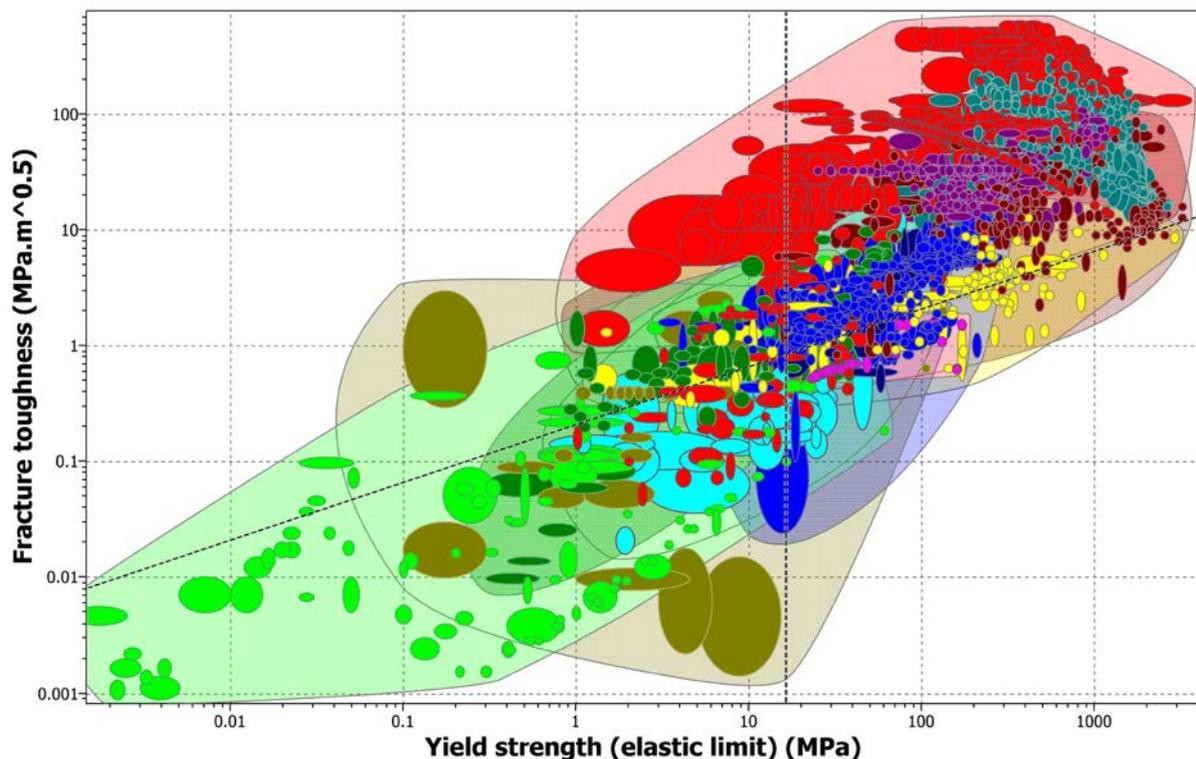
Stresses in the container at low storage temperatures (low stress shown in green, high stress in red)

¹Smithers Rapra (2016): <http://www.smithersrapra.com/news/2016/march/how-and-why-failure-occurs-in-plastics-and-rubber>

The chemical container needed to be inert to the solvent and to withstand extreme temperatures (ranging between -20°C and +50°C) without fracturing, fatiguing, or yielding to fluctuating internal pressures. Further requirements included shock resistance, a reduced carbon footprint, that the material be recyclable, improvement of price versus weight, and that the material would be easily implemented into an established production processes – in this case, injection molding – at minimal long-term cost. These factors, combined with novel cap and seal designs, meant that an initial material selection study was essential to eliminate non-feasible materials and provide candidates for further assessment using COMSOL Multiphysics® simulations.

Continuum Blue began by using CES Selector to narrow down the choice based on chemical resistance, before moving through a detailed set of requirements. In less than two hours, the consultancy was able to probe a unique database that covers all classes of engineering materials and pinpoint desirable characteristics, whilst eliminating materials that don't meet the selection criteria. The MaterialUniverse database contains 3,500 unique data records covering virtually all purchasable engineering materials and enables users to filter based on any of hundreds of material properties—from resistance to alkalis, through to mechanical, physical, and environmental factors.

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Using CES Selector to plot yield strength against fracture toughness

CES Selector then provides advanced charting and comparison capabilities, enabling trade-offs to be made. Continuum Blue, for example, plotted yield strength against fracture toughness and used CES Selector's graphical features to place 'index' lines on the plot that represent equivalent performance in resisting failure under pressure. Materials could be quickly compared against the original HDPE and each other for a range of such requirements and results presented in a summary table of results. With optimal alternative materials options identified, Continuum Blue was then able to bring up a list of suppliers and begin identifying specific purchasable grades that might do the job.

Delivering a solution in weeks, not months

It took just a few hours to identify likely materials using CES Selector, whereas getting the same level of information directly from suppliers and online sources would take months, and there would be no guarantee the data format or the test data had been conducted to specific international standards. A further benefit is that running Multiphysics simulations for assessment of factors like dynamic response over time can take days, or even weeks, but by pre-validating the material choices with CES Selector, Continuum Blue could ensure that only the feasible Multiphysics simulations were run.

In the end, Continuum Blue was able to ensure that the new material was not disruptive by matching the parameters of the client's injection molding process. Not only was the new material more suitable, it also represented a cost saving of 2-3%. Given the vast reduction in consultancy time from months to weeks, the overall project cost was dramatically reduced as well, representing significant savings to the client in both the short and long term.

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Dr Yeoman concluded: "Using CES Selector, we found a specific solution for a particular organic solvent, which was an easy material replacement for the client's production system, with minor changes to their injection molding process."