Wilde

Pegler Yorkshire

Cold Forming Simulation & Die Stress Analysis of Brass Plumbing Components

IMI Yorkshire Fittings, now merged with Pegler Yorkshire, is a leading manufacturer of fittings to the plumbing and heating industry. Wilde Analysis helped the company to improve their extrusion process design by carrying out cold forming simulations and die stress analyses.

Company

IMI Yorkshire Fittings grew out of Yorkshire Copper Works Ltd of Leeds, which was founded in 1909. In 1958, Yorkshire Copper Works merged with the Metals Division of Imperial Chemical Industries (ICI) to form Yorkshire Imperial Metals, with ICI owning a 50% share.

In 1968, Imperial Metal Industries (IMI) was created by ICI and acquired Yorkshire's half share of the business. Yorkshire Fittings then became IMI Yorkshire Fittings. In 2009, this company merged with Pegler Ltd to create Pegler Yorkshire.

Pegler Yorkshire is part of the Flow Control division of Aalberts Industries NV. It designs and manufactures innovative branded flow control solutions for the plumbing and heating industry worldwide. It invests heavily in its manufacturing facilities at an average rate of £3.5 million per year.

Challenge

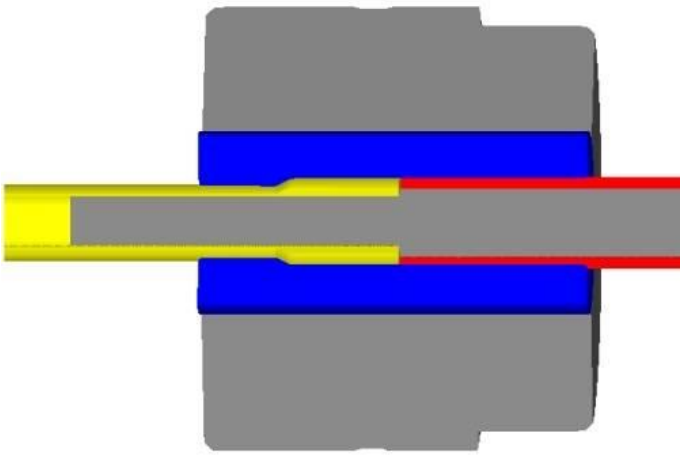
The first process was an existing manufacturing operation that ran satisfactorily. The second process was designed to produce a longer workpiece section but in service was experiencing early die failures. It was proposed to use FEA software to investigate the differences in the die stresses generated by the two processes to identify potential reasons for early failure.

> “” The results of the simulation **reduced the company's concerns** over the consequences of adding this process to their manufacturing operations.

Solution

The models comprised the workpiece to be formed and a multiple die assembly including carbide and steel components. A non-linear forming simulation of each process was run for the complete extrusion of the workpiece.

As the forming loads varied during the process, a series of die stress analyses were performed at different stages to locate the maximum levels and changes in stress. Each analysis modelled the combined stresses due to the interference fit between the carbide insert and steel casing, and the applied forming pressures.



Business Benefits

The simulations predicted a tensile axial stress near to the throat of the insert due to the interference with the steel ring. This tensile stress was shown to be approximately 25% greater in the modified dies than in the original dies, potentially leading to a reduced operating life. In addition, the predicted forging load for the modified process

was found to be approximately 50% higher than for the original process.

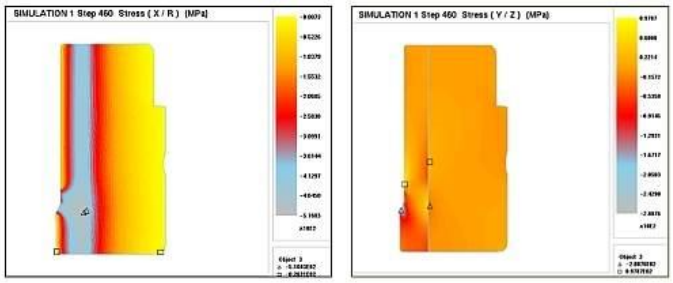


Fig 2: Die Stress Analysis (Courtesy: IMI Yorkshire Fittings)

Further simulation work was carried out for the company to assess the performance of a subsequent tube extrusion process. It was predicted that any damage to the workpiece generated by the tube extrusion process, as measured by the normalised Cockcroft and Latham ductile fracture criteria, would not be significant.

Furthermore, the simulation did not indicate any significant over sizing of the internal bore due to this process. The results of this simulation reduced the company's concerns over the consequences of adding this process to their manufacturing operations.

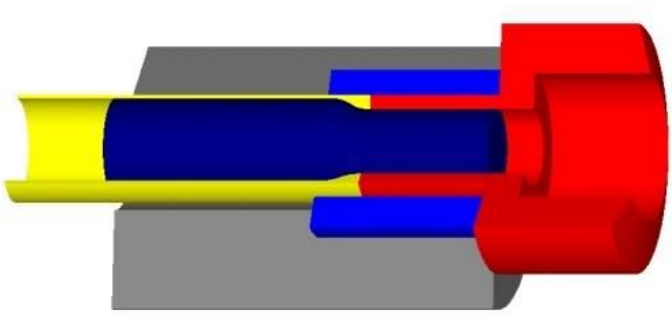


Fig 3: Cold forming extrusion (Courtesy: IMI Yorkshire Fittings)