COMBINING CONVENTIONAL AND ADDITIVE MANUFACTURING METHODS TO DELIVER AM HYBRID FILTERS

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Metal filter media are manufactured from conventional (CON) processes from perforated plate and one or more layers of woven wire mesh. The conventional processes are multi-step involving: computerised mechanical punching of plate, rolling and forming, manufacture of handles and flanges, welding in place, followed by mesh shaping and further welding. For customised filtration media many of these steps are hand operations by skilled operators and is labour intensive. We have previously utilised Additive Manufacturing (AM), where the component is manufactured layer by layer to create innovative filtration media. The AM process involves the creation of a 3D CAD design of the filter media, which is then sliced and uploaded to the AM machine, the laser then melts the metal powder according to the CAD design in each layer, the components are removed from the buildplate and post-processed. A common perception of the AM process is that it is an expensive process. However conventional CON processes for customised filter media production are labour intensive and therefore utilising an AM process to manufacture customised filter media may be cost effective.

Here we will compare the CON processes and the AM processes in the manufacture of two comparable filter designs, one CON filter and one AM filter, as shown in Figure 1, with respect to tooling, set up, labour time in the individual process step, material, waste to evaluate the advantages and disadvantages of the processes to determine the cost effectiveness of each process. A simple small witches hat filter was selected to be manufactured by CON and by AM (Fig. 1) which comprises of a single layer of mesh with a flange compared (B) to an AM equivalent (A). Production batch size for the witches hat was 80 Off CON filters and 80 Off AM filters.

The CON production has 6 process steps and the AM process has 4 steps. The labour time, material costs, waste produced were recorded. The cost of each process was calculated and the results compared.

The overall labour time in the CON process was 22% greater than the AM process. Material costs and waste produced was less in the AM process compared to the CON process. However post-processing time for the AM components was greater than the CON filters. Overall there was no great difference in the cost-effectiveness of the processes involved. However the AM flange finishing involved more time and the upper surface of the flange was not as smooth as the CON flange, thus did not produce such a close fit when the filter was sited in position. The CON filter had a decreased open area where the mesh overlapped and therefore was less efficient compared to the AM filter. Therefore a further innovation in the design of this witches hat filter was made to incorporate the consistency of the AM latticework with the less post-processing requiring conventional flange. A new method of manufacture was devised to incorporate these two features and the relative costs of manufacture recorded for the hybrid CON/AM filter were examined.