Advances in metal forming technology

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The trouble with metal forming in the high value manufacturing context
It’s old technology, isn’t it?

‘One of the oldest metalworking processes … smith using hammer and anvil …. Production and working of iron dates back to the 12th century’

Wikipedia
Competing technologies are inherently more ‘high value’?

- Powder metallurgy
- Investment casting
- Additive layer manufacture
- High speed machining
- Metal injection moulding
It’s not exactly flexible or agile

Source:

Injection moulding method
3D printing method

COST PER UNIT

UNITS

MAKERS
The New Industrial Revolution
Bestselling author of The Long Tail
CHRIS ANDERSON

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Everything is going to be made out of composites anyway, isn’t it?

Source: www.compositesworld.com

Source: Hexcel Corp., Aerostrategy
And it’s all a bit tricky isn’t it?
Finding a way for metal forming
What are the necessary developments?
Properties for challenging environments

- Forged products have favourable microstructure and mechanical properties
- Advanced applications are calling for tailored or localised mechanical properties
- Significant potential exists from using forming and forging in combination with the ‘competing’ technologies
Taking away the configurability argument - Breaking the mold

If tooling costs make flexibility and configurability uneconomic then eliminate

- Incremental sheet forming – a die-less method
- Low cost ceramic dies – enable SPF as a prototyping technology
- Additively manufactured die inserts – could change the economics of low volume forming
- Incremental bulk deformation processes offer close to size capability with reduced dedicated tooling

**IF**
- finishing operations eliminated, better spring back compensation, and automation to make low volume production economic
- a general purpose substrate reinforcement design approach exists and if the dies can be reliably and accurately machined
- an effective design methodology can be developed and the right combination of die block and insert material selected
- the product of the process is properly understood and validated versus design and lifing requirements
Addressing the scientific challenges

A holistic equipment portfolio

... to enable a scientific, predictive approach to improvement
High value manufacturing?

“By definition, high value manufacturing is the most specialist type of work that also yields the largest rewards. It’s characterized by a high level of R&D intensity which leads to growth”

-Dick Elsy, CEO – High Value Manufacturing Catapult
Catapult Centres 2013 – Transforming the Capacity for Innovation
London, October 2013

- Specialised ✓ (for large and high integrity applications)
- Largest rewards ? (specialist forgings are very costly, but....)
- High R&D intensity ✓ (in order to address configurability issues)

AND barriers to entry

- High capital costs ✓
- Regulatory approvals for high demand applications ✓
- New materials behaviour can enable next generation products ✓
But what about really addressing the issues?

A product technology which is READY TO LOAD the catapult

A supply chain which is READY TO RECEIVE the developed capability

A CATAPULT which is READY TO LAUNCH the capability

Opportunity

Potential

Value

Manufacturing developments should feed national prosperity
In Summary

- Forming and forging processes can be difficult to position in the high value manufacturing context
- New materials and processes have already reshaped the manufacturing landscape
- Despite this:
  - A range of high integrity applications will continue to need forging
  - Combining forging/forming with alternative production technologies can enable next generation products
  - Opportunities exist to break the economic barrier of tooling and provide flexible and configurable methods
- It is and can be high value manufacturing
- Really achieving ADVANCES IN METAL FORMING requires a total route to market approach, including overcoming the image problem