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INDUSTRY DIRECTION^{TM}

Are bespoke manufacturing for mining ways of the future?

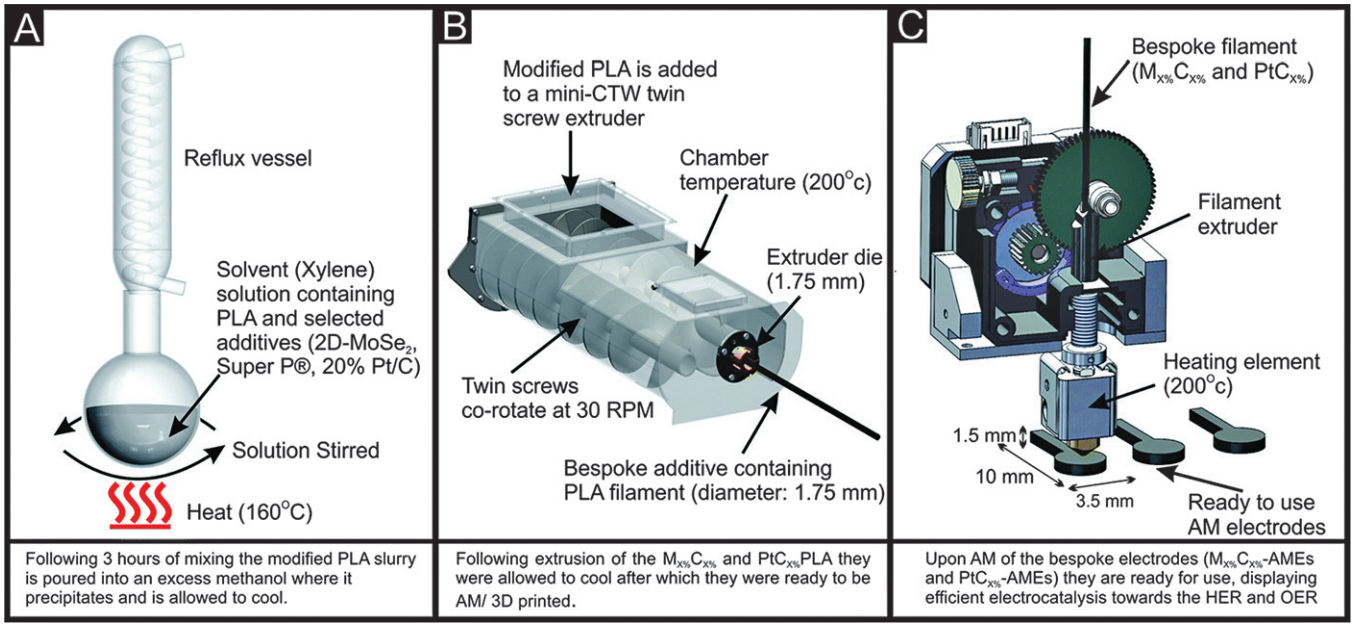
Consider a mining scheme where the mining conditions will determine the size and specifications of the equipment and facilities. Think of an electric shovel and mine pump getting power from the same capacity sources. The voltage regulation mechanism is not outside the machine but inside of it and can be dismantled and refitted whenever required. The advantage is adaptability and localization and even utilization of resources in areas where they were not even contemplated for use. Think of a shovel that can work productively and profitably even at lesser demand than it was originally thought of. This is the realm of mining by bespoke manufacturing.

The word "Bespoke" is derived from the verb bespeak, meaning to "speak for something". The particular meaning of the verb form is first cited from 1583 and given in the Oxford English Dictionary: "to speak for, to arrange for, and engage beforehand: to 'order' (goods)." The adjective "bespoken" means "ordered, commissioned, arranged for" and is first cited from 1607. American English tends to use the word custom instead, as in a custom car or custom motorcycle. Nevertheless, bespoke has seen increased usage in American English during the 21st century.The manufacturing process from the bespoke perspective will be built around the customer - where each customer will represent a unique design and, as a result, a unique manufacturing experience. Additive manufacturing and 3D printing are the carriers of this innovation. Additive manufacturing or 3D-printing is used to create bespoke items in many fields, such as defence, aerospace and medicine. Despite the progress made in 3D-printing significant challenges remain in terms of creating a material capable of adapting to ever-changing mining conditions. For example, manufacturing hard cutting tools for rock cutting will remain challenge for times to come. New methods of fabrication, including additive manufacturing, have overcome some of these challenges and given rise to an increased prospect of bespoke technologies.

Think of the pump problem. Today in mining we go about the capacity and flow characteristics in selecting a pump. Now consider the pump is supposed to pump different waters in different parts of the mine. The pump dealing with neutral water should not be used in the acidic water. The pump for acidic water needs certain protection, a customization. This applies to many places. The seals and bearings manufacturer, Morgan Advanced Materials has announced their pump components are applicable to a variety of applications and industries. Morgan offers a selection of high performance axial and radial bearings, seal face components, rotors and vanes, in a range of sizes and compositions. The pump components are manufactured from specialized formulations of carbon/graphite and silicon carbide materials, giving them suitable tribological and wear characteristics. The components are all chemically inert, dimensionally stable products and are used in applications in the aerospace, automotive, chemical processing, healthcare, mining, oil & gas, pharmaceuticals, food and industrial sectors. Morgan has adapted itself, with extensive experience, to developing high-performance pump components and are experts in working closely with customers to tailor solutions to specific end-use scenarios. These efficiently-produced, custom-made components are machined to solve unique challenges in the most demanding of environments.

AM/BESPOKE technologies fabricate models by fusing, sintering or polymerisation of materials in predetermined layers with no needs of tools. AM/BESPOKE makes possible the manufacture of complex geometries including internal part detail that are approximately not possible to manufacture using machining and moulding processes, because process does not require predetermined tool paths, draft angles and under cuts.

In AM/BESPOKE the layers of a model are formed by slicing CAD data with professional software. All AM/BESPOKE system work on the same principle; however, layer thickness depend upon parameters and machine being used and thickness of layer range from 10µm up to 200µm. Layers



An example of bespoke/additive manufacturing

are clearly visible on the part surface in AM operation, which controls the quality of final product. The relation between thickness of layer and surface orientation is known as staircase effect. However, thinner the layer is the longer the processing time and higher the part resolution.

Layers in AM/BESPOKE are built up at the top of the previous one in z axis. After layer gets processed the work platform is dropped down by the single layer thickness in z axis and the fresh material layer is recoated differently for number of other methods. In resin based system traversing edge flatten the resin, in powder based system deposited powder is spread using roller or wiper, in some system the material is deposited through a nozzle which deposits the required material. Because recoating time is even longer than the layer processing time. For that sake multiple parts are building together in the time of single material recoating build. Different software's are available to position and orient part so that maximum number of parts can be built together. Available software's are VISCAM RP and Smart Space used in MAGICS.

Some delicate parts produced through AM technologies need a support structure to hold the part in work platform during the build process. All AM machine uses different support structure that are designed from specific material for effective use of build parts. Commonly used support structures are thin small pointed teeth to minimising the part contact so that they can be removed easily with the hand tools.

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