

**We are searching for innovative binder solutions for the manufacture of moulds and cores used in the production of metal castings.**

Typically, silica sand is mixed with a small quantity (1-3%) of binder material, and then either rammed around a pattern (moulding) or pneumatically forced into a pattern cavity (coremaking) and set. Molten metal is then poured into and around the resulting product to provide the desired shape of the metal part being cast. Binders used for moulding are typically self-setting, in that after mixing two or more binder components onto the sand, there is a short delay before the mixture starts to set hard. Binders used for core making are typically gas-cured, in that a catalysing / hardening gaseous component is forced through the sand / binder mixture to set it hard.

The moulding and core making processes demand robust, environmentally acceptable binder systems with easy breakdown and removal after casting. Whilst current organic systems (predominantly based around phenol formaldehyde base resins) provide exceptional performance, there are a number of issues surrounding their environmental profile – including health issues of users, volatile organic compounds, waste streams, odour and thermal breakdown products. There is therefore a requirement to source a new, environmentally acceptable binder system. This could be based on inorganic, “clean” organic or hybrid derivatives, and should offer an immediate advantage over current systems, in terms of health, safety and environmental issues. Key criteria include:-

- **Either a controllable self-setting system, where work-time could be varied by the use of different grades of hardener, or different addition levels of hardener OR a system which could achieve almost instantaneous cure through the application of a low hazard gaseous hardener / catalyst (e.g. CO<sub>2</sub>)**
- **Low toxicity / low hazard material in terms of labelling and occupational exposure limits, and with zero or very low levels of free formaldehyde**
- **High strength development at low (<5%) addition levels**
- **Chemical curing reaction, NOT a dehydration process. The curing mechanism should not be dependent on an external heat source and should take place under ambient conditions**
- **Low cost, high volume product. Market volumes are measured in thousands of tonnes, but cost to the manufacturer (our client) would need to be <€2000 per tonne given volume production**
- **No deterioration in strength on ambient storage for several days, and preferably an increase in strength**
- **No adverse chemical reaction between the aggregate / binder and the metal during casting process**

Please note the following binder systems are currently known and not of interest:

- Organic:- Amine-cured polyurethane, SO<sub>2</sub> cured furan or epoxy, ester-cured alkaline phenolic, CO<sub>2</sub> cured alkaline phenolic, acid cured urea-formaldehyde / phenol formaldehyde / furan (by furan is meant polymers or blends with furfuryl alcohol).
- Inorganic:- CO<sub>2</sub> or ester-cured sodium silicate, microwave-cured sodium silicate, machinable salt (sodium chloride) blocks.

We are willing to explore any reasonable commercial arrangements, including licensing in of proprietary or innovative products, systems or technologies, funding of a research programme, strategic alliances or partnering arrangements and outright purchase. With the right solution, our client is able to quickly access global markets. Please send preliminary information on any proposed opportunity – including a short description, technical merits and initial suggestions on possible methods of co-operation to – Mrs Elaine Rhodes, Operations Manager. Thank you!