MONASH University

MONASH INNOVATION

COST-EFFECTIVE SUBSTITUTE FOR BLAST FURNACE COKE

A substitute for metallurgical coal in blast furnace applications without the availability and cost constraints of current products. Our modified coal-based product has properties very similar to coke and offers the potential to significantly reduce the cost of iron and steel production.

- **Prepared from cheaper and more readily available materials than conventional coking coals**
- **High strength and low reactivity, similar to conventional metallurgical coke**
- **Potential to significantly reduce the cost of iron and steel production**

Table 1. Properties of Monash substitute products vs. metallurgical coke

Product	Yield (wt %)	Bulk Density (g/cm3)	True Density (g/cm3)	Compressive Strength (MPa)	Surface Area (m2/g)	Reactivity (modified CRI*, %)
VBC + No Additive	50	1.13	2.00	100	657	80
VBC + Additive A	55	1.39	2.01	250	27	23
VBC + Additive B	53	1.29	2.02	29	78	26
Metallurgical Coke	75	0.87	1.90	20	18	13

THE CHALLENGE

Production of iron and steel is a core industry with products used in a very wide range of applications in both developed and developing economies.

Around 70% of iron and steel production makes use of coke which is derived from metallurgical or coking coal. Annual world demand for coke is about 700 Mt, with China and Australia being the major suppliers. Demand is expected to increase in line with increasing urbanisation around the world, although demand does vary with overall economic activity.

Due to the limited (and diminishing) supply of good quality coking coals, coke makes up the most costly component of the blast furnace charge in steel production. Several properties of the coke are important considerations in this application:

- High compressive strength
- Low reactivity
- Low levels of minerals and sulphur

Untreated brown coal does not meet the requirements for the blast furnace charge, due to the high moisture content, high reactivity and low strength, even though levels of contamination are low.

Current processes for obtaining coke-like materials from brown coals generate a material of sufficient cold strength; however the measured reactivity is too high and/or the processes are too expensive and wasteful to be commercially viable.

There is a clear need for new coke substitutes to reduce iron and steel production costs.

THE TECHNOLOGY

Monash researchers have developed a new substitute for blast furnace coke based on Victorian brown coal (VBC). It can be used as a cheaper substitute for all or a significant part of the coke charge to a blast furnace.

We have developed a process which, under specified conditions, gives a product that has properties close to those of a blast furnace coke. A range of binders has been tested, with two performing particularly well (Table 1).

We have shown that low reactivity of the coke correlates with a high proportion of graphitic structure. Our product has a relatively low reactivity, approaching that of blast furnace coke and has a reasonable proportion of graphitic structure, less than that of a blast furnace coke under the conditions trialled so far, but much higher than that of other low rank coal-derived solid carbonization products.

Like blast furnace coke, our new product has a low surface area and micropore volume. Its cold strength is higher than that of blast furnace coke.

Intellectual property: Australian provisional patent filed (2016).

THE OPPORTUNITY

We seek a partner to develop this technology to the point of commercial production.

Our team led by Professor Alan Chaffee has significant experience in the area of brown coal and its applications to industry.

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