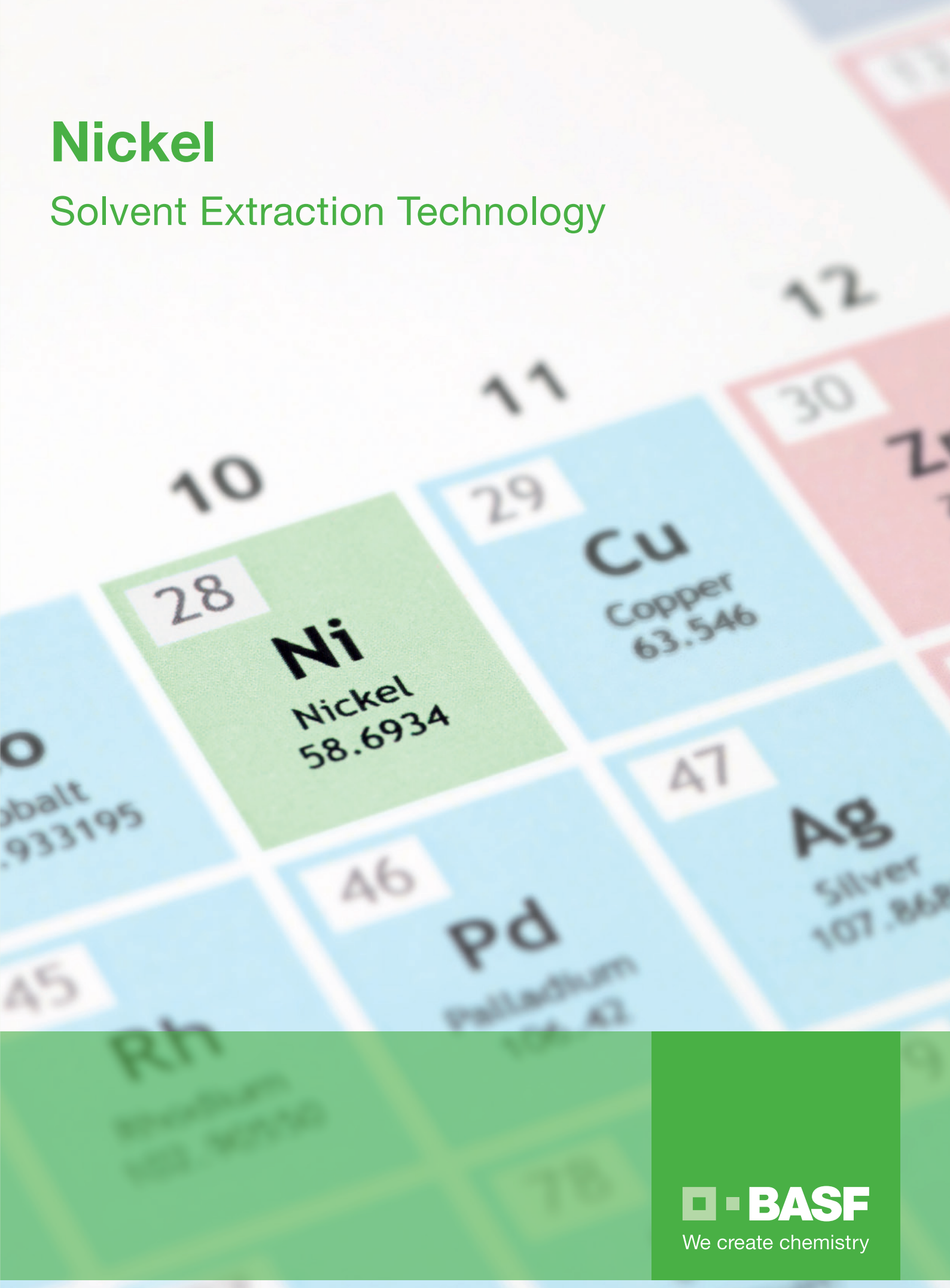
Nickel

Solvent Extraction Technology



BASF
We create chemistry

BASF technology for the recovery of nickel from laterites

Nickel laterite ores are becoming an increasingly important source of nickel and cobalt. BASF solvent extraction reagents are used in a nickel production plant, Queensland Nickel Inc. (QNI), to extract nickel from ammonia solutions. LIX® 87QN reagent was developed to fit into a QNI-developed nickel recovery process based on a modified Caron process. While operating, Cawse Nickel Operations used a flowsheet originally conceived by BASF and further developed by Cawse, for the recovery of nickel from laterite ores using High Pressure Acid Leaching (HPAL).

The basic elements of the front half of the process used at Cawse are High Pressure Acid Leaching (HPAL) of the laterite, solid liquid separation, pH adjustment to remove iron and then the subsequent precipitation of the base metals nickel, copper, zinc and cobalt as hydroxides. The refinery portion of the plant releached the crystalline base metal hydroxide with ammonia under oxidizing conditions, followed by solvent extraction with LIX® 84-INS and electrowinning of the nickel. Cobalt is recovered from the nickel-depleted raffinate by precipitation of cobalt sulfide using sodium hydrosulphide. The cobalt product can be sold or further treated to produce high-purity cobalt metal.

Advantages of the Cawse flowsheet

1. The process has been proven on an industrial scale producing 8,000 tonnes/year nickel cathode.
2. The front half of the process produces an intermediate crystalline base metal hydroxide that can either be sold to other nickel producers or further treated to produce high-purity nickel cathode and cobalt sulfide. The hydroxide intermediate can be stockpiled to provide a steady nickel feed to the refinery portion of the plant, even when the HPAL circuit is shut down.
3. The hydroxide precipitation step followed by an ammonia re-leach is largely selective for Ni, Co, Cu and Zn while rejecting troublesome Mn and Cr from the SX feed.
4. Use of MgO as the base in the hydroxide precipitation step minimizes the formation of gypsum in downstream processing.
5. The nickel concentration of the ammonia leach solution can be controlled to minimize the size of the nickel SX plant. Typically, the ammonia leach solution has a concentration of 10–20 g/l nickel.
6. The final nickel product is a high-purity electrowon cathode, a readily marketable product. Cobalt is recovered as marketable cobalt sulfide product. There is also the potential to produce nickel sulfate.
7. Ammonia is recycled, resulting in a low ammonia consumption rate per tonne of nickel produced.
8. Metal containing intermediates are recycled resulting in very high metal recovery.
9. The process employs only one SX circuit and one extractant type. This removes the possibility of cross contamination of circuit organics.

PRODUCTION OF BASE METAL HYDROXIDE INTERMEDIATE

Schematic flowsheet for the HPAL process to recover nickel at Cawse Nickel Operations

For more information, please reference:

The Recovery of Nickel from High-Pressure Acid Leach Solutions Using Mixed Hydroxide Product – LIX® 84-INS Technology
by Murdoch Mackenzie, Michael Vimig and Angus Feather

Nickel Laterite Processing: Recovery of Nickel from Ammoniacal Leach Liquors
by J.M.W. Mackenzie, MJ. Virnig, G.A. Wolfe and R.D.Boley

Ammoniacal Solvent Extraction at Queensland Nickel, Process Installation and Operation
by J.G. Reid and MJ. Price

Cawse Nickel plant

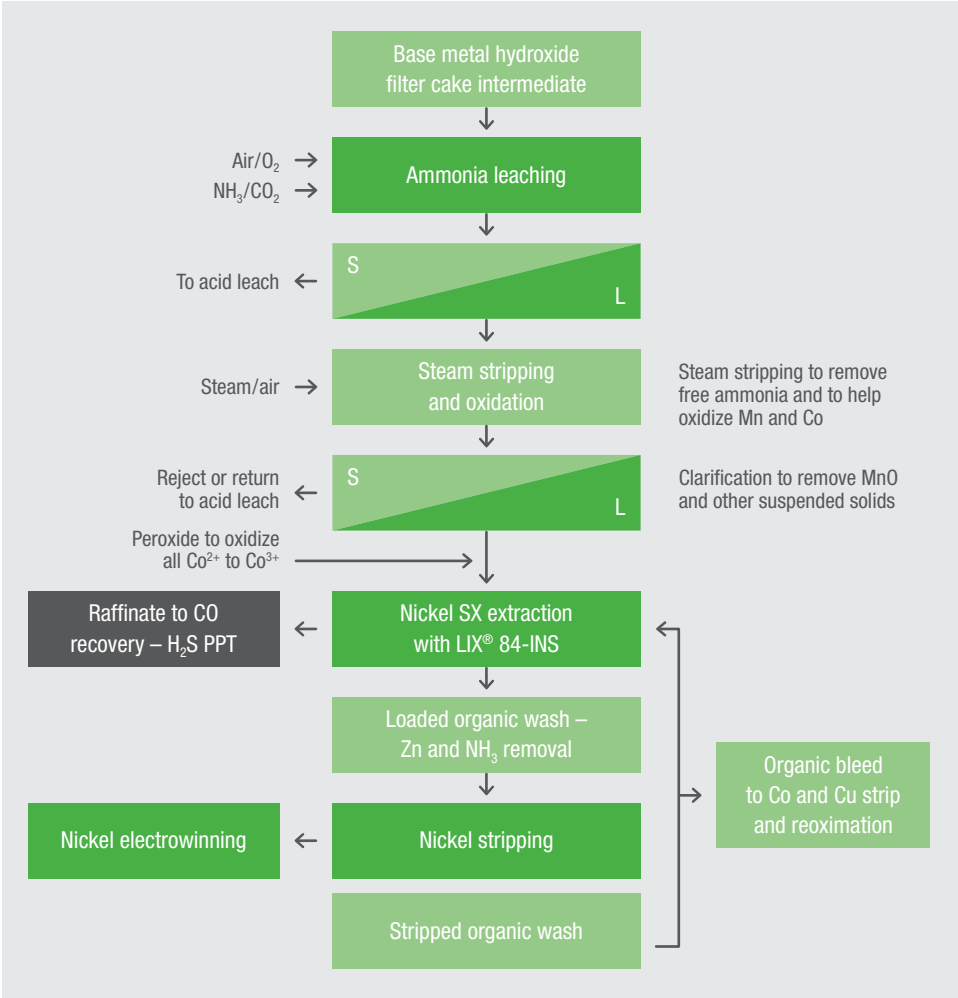
Cobalt stripping, copper stripping and circuit organic re-oximation

To control the concentration of cobalt and copper on the circuit organic, a bleed stream of the circuit organic is treated to remove copper and cobalt, both of which can be recovered. If there is sufficient copper present, cathode copper or copper sulfate can be produced. Cobalt is recovered as cobalt sulfide. After copper and cobalt removal, the organic bleed stream passes to re-oximation to minimize solvent extraction reagent consumption.

Aspects of the BASF Nickel technology are covered by US Patent 5,976,218.

Major operating parameters of the SX-EW circuit

AMMONIA LEACH – LIX® 84-INS NICKEL SX – ELECTROWINNING



Europe

BASF plc
Cleckheaton Road
Low Moor, Bradford
BD12 0JZ
Great Britain
Phone: +44 1274 417 000
Fax: +44 1274 606 499

North America

BASF Corporation
3231 E Valencia Road
Tucson, AZ 85706
US
Phone: +1 520 622 8891
Fax: +1 520 624 0912

South America

BASF CHILE S.A.
Av. Carrascal Nº 3851
Quinta Normal
Santiago
Chile
Phone: +56 2 2640 7000
Fax: +56 2 775 3095

Africa

BASF South Africa (Pty) Ltd.
852 Sixteenth Road
Midrand, P.O. Box 2801
Halfway House 1685
South Africa
Phone: +27 11 203 2400
Fax: +27 11 203 2431

Australia

BASF Australia Ltd.
Level 12, 28 Freshwater Place
VIC 3006, Southbank
Australia
Phone: +613 8855 6600
Fax: +613 8855 6511

For further information:
miningsolutions@basf.com
www.mining-solutions.basf.com

EVG1255e

BASF
We create chemistry