神华煤直接液化项目最新进展
Recent Progress of Shenhua Direct Coal Liquefaction Project

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2014年3月
March 2014

一、神华煤直接液化工艺

I. Shenhua Direct Coal Liquefaction Process

一、采用自主知识产权的863液化高效催化剂

I. The 863 highly-efficient Liquefaction Catalyst with Independent IPR Employed

- **863 催化剂价格低、活性高、添加量少，油收率高。The 863 catalyst is of low cost, high activity, low volume of addition, and high oil yield.**

二、全部采用预加氢的供氢溶剂 II. An hydrogen donating solvent that is pre-hydrogenated is used in full

- 循环溶剂采用预加氢工艺，溶剂性质稳定,溶剂供氢性能好。**The solvent recycling process employs pre-hydrogenation; the solvent property is stable, the hydrogen donating performance of the solvent is outstanding.**

- 供氢性循环溶剂的组成上有所创新，更有利于生产合格的柴油。**The composition of hydrogen donating solvent cycling is innovative, and helpful for producing on-spec diesel.**

三、采用强制内循环的悬浮床反应器
III. Ebullating Bed Reactor with Forced Internal Circulation

- 通过进料温度控制反应温度，反应器内液速高，反应器内没有矿物质沉积 。 **The reaction temperature is controlled by feeding temperature; the liquid velocity within the reactor is high; there is no mineral sedimentation within the reactor.**

四、采用成熟的减压蒸馏固液分离技术

IV. Proven Vacuum Distillation Technology for Separation of Solid and Liquid phases

- 减压蒸馏溶剂不含沥青，为进一步提高溶剂的质量提供了可能。**The vacuum distillation solvent does not contain bitumen, offering the possibility for further upgrading of the solvent quality.**

五、溶剂加氢第一次采用悬浮床加氢反应器

V. Ebullating Hydrogenation Reactor is Employed for the First Time for Solvent Hydrogenation

- 由于采用悬浮床反应器，催化剂每天更新，加氢深度稳定。**Thanks to the ebullating bed reactor employed, the catalyst is replaced every day, with stable hydrogenation degree.**

二、示范工程概况

II. Overview of the Demo Project

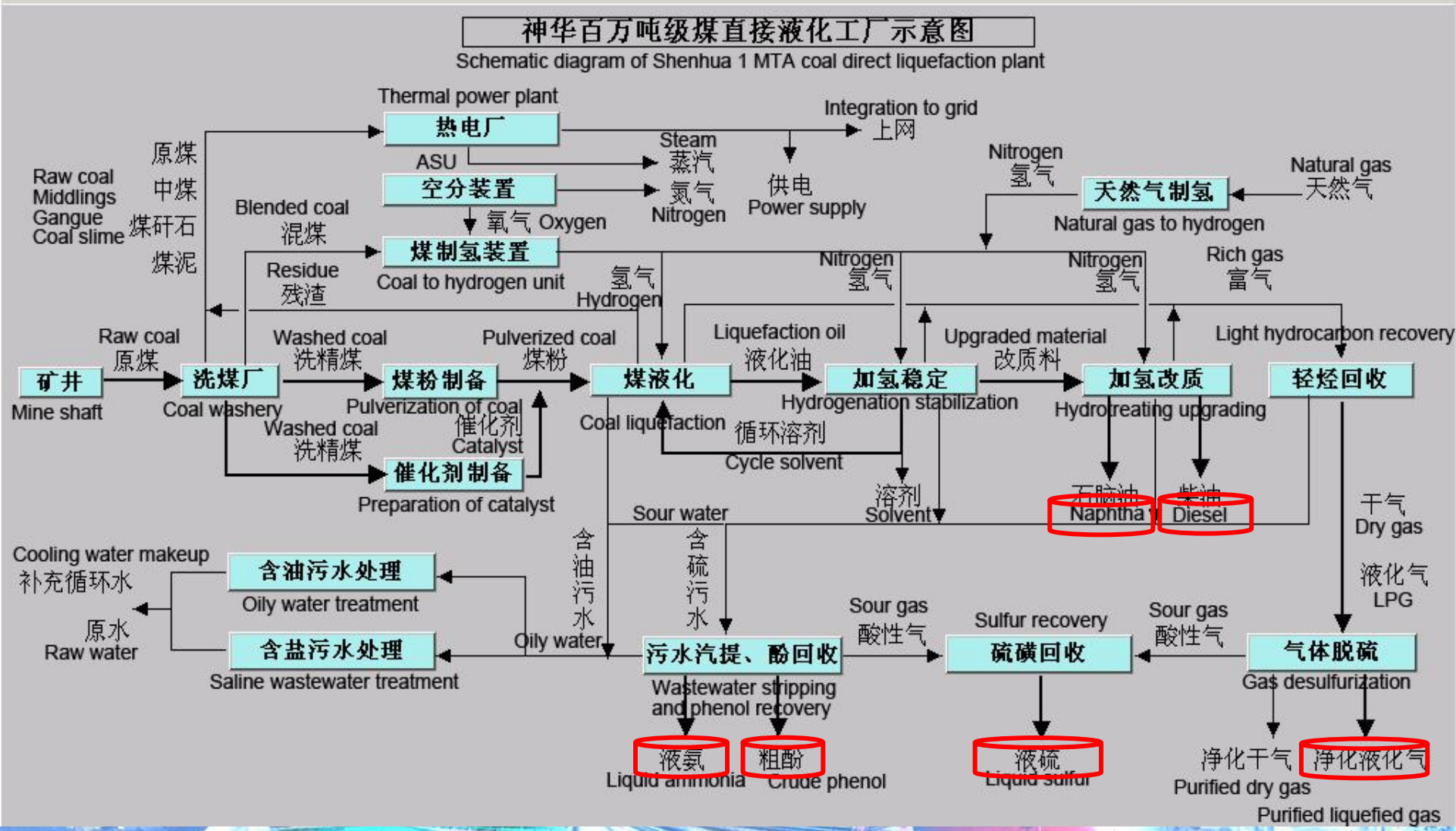
- 2004年8月动工，2008年5月完成。
  Construction was kicked off in August 2004, and completed in May 2008.

- 液化原料煤：6000t/d
  The rate of feed coal to be liquefied: 6000t/d

- 气化原料煤：4000t/d
  Feed coal to be gasified: 4000t/d

- 产品：100万吨/年
  Production capacity: 1 MTA

神華集團


神华百万吨级煤直接液化工厂示意图
Schematic diagram of Shenhua 1 MTA coal direct liquefaction plant
Thermal power plant
热电厂
Integration to grid
上网
Steam
蒸汽
ASU
空分装置
氮气
Nitrogen
供电
Power supply
氧气 Oxygen
Raw coal
Middlings
Gangue
Coal slime
原煤
中煤
煤矸石
煤泥
Blended coal
混煤
煤制氢装置
Coal to hydrogen unit
Residue
残渣
氢气
Hydrogen
Nitrogen
氮气
天然气制氢
Natural gas to hydrogen
Natural gas
天然气
Rich gas
富气
Raw coal
原煤
矿井
Mine shaft
洗煤厂
Coal washery
Washed coal
洗精煤
煤粉制备
Pulverization of coal
Pulverized coal
煤粉
煤液化
Coal liquefaction
Liquefaction oil
液化油
加氢稳定
Hydrogenation stabilization
Upgraded material
改质料
加氢改质
Hydrotreating upgrading
轻烃回收
Light hydrocarbon recovery
Washed coal
洗精煤
催化剂
Catalyst
催化剂制备
Preparation of catalyst
循环溶剂
Cycle solvent
溶剂
Solvent
石脑油
Naphtha
柴油
Diesel
干气
Dry gas
液化气
LPG
Sour water
含油污水
含硫污水
Cooling water makeup
补充循环水
原水
Raw water
含油污水处理
Oily water treatment
含盐污水处理
Saline wastewater treatment
Oily water
污水汽提、酚回收
Wastewater stripping and phenol recovery
Sour gas
酸性气
硫磺回收
Sulfur recovery
气体脱硫
Gas desulfurization
液氨
Liquid ammonia
粗酚
Crude phenol
液硫
Liquid sulfur
净化干气
Purified dry gas
净化液化气
Purified liquefied gas

催化剂生产单元
Catalyst Production Unit

煤直接液化单元

Direct Coal Liquefaction Unit

溶剂加氢单元

Solvent Hydrogenation Unit

三、示范工程运行情况

III. Operation Status of the Demo Project

年　　份 Year	当年投煤运转时间　天 Coal feeding and running time in the year, day	当年生产成品油　t Product oil produced in the year, t
2009年 2009	**61**	**65000**
2010年 2010	**215**	**443000**
2011年 2011	**281**	**790000**
2012年 2012	**302**	**865000**
2013年 2013	**315**	**888000**
合计 Total	**1174**	**3051000**

- **2013年实现了一年一次检修，到目前为止实现了单次连续投煤时间超过了到9个月**
  Maintenance was conducted just once in 2013; up to now, the plant has operated continuously with coal feeding for more than 9 months.

- **高差压减压阀单次连续运转超过2500小时**
  The high DP relief valve has operated continuously for over 2500 hours.

- **吨产品耗水从设计的10吨，降至目前的6吨。污水完全达到零排放。**
  Water consumption per ton of product has dropped from the design 10 tons to current 6 tons. Zero discharge of waste water has been fully achieved.

- 国家能源局组织专家于2014年2月11日12时－14日12时进行了72小时标定：
  National Energy Administration caused experts to perform a 72-hour calibration from 12:00 on February 11 to 12:00 on February 14, 2014 as follows:
- (1)吨油综合能耗：1.69tce/t；
  (1) total energy consumption per ton of oil: 1.69tce/t;
- (2)吨油原料煤耗：3.23tce/t；
  (2) feed coal consumption per ton of oil: 3.23tce/t;
- (3)吨油水耗：5.82t/t；
  (3) water consumption per ton of oil: 5.82t / t;
- (4)能源转化效率：58.0%；
  (4) energy conversion efficiency: 58.0%;

4、结论
Conclusions

标定结果表明：工艺技术先进，装置设计合理，设备选择恰当，装置运行稳定、安全可靠，产品质量特点明显，能源转化效率高，三废排放达到国家标准要求，已取得了明显的社会效益，具有较好的经济效益。

Calibration results show advanced process technology; reasonable plant design; proper equipment selection; stable, safe and reliable installation; distinct product quality characteristics; high energy conversion efficiency; waste emissions meeting national standards; and remarkable social benefit and good economic benefit achieved.

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THANKS!