ALPHA– Chemetics® Sulphuric Acid Plant Energy Recovery System

ALPHA–凯密迪硫酸装置热能回收系统

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ALPHA (Acid Low Pressure Heat Absorption) is Chemetics® Inc. energy recovery system for sulphuric acid plants. In partnership with New Hongda an industrial scale application of the Chemetics® ALPHA system was installed at Jiangsu Lvling Chemical Industry Group Co. 600 mtpd sulphur burning sulphuric acid plant and was successfully commissioned in 2013.

ALPHA（酸低压热吸收）是 Chemetics®公司开发的硫酸装置热能回收系统， 通过与新宏大合作，以将此系统安装在江苏绿陵化工集团有限公司的 600 MTPD 硫磺制酸装置中，并于 2013 年成功投产。

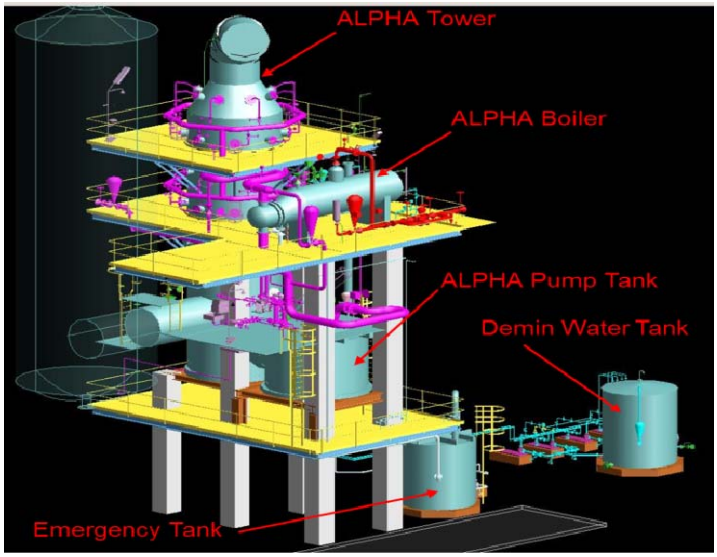
In traditional sulphur burning sulphuric acid plants, an approximate 70% of the energy is recovered in the process whereas the remaining 30% is rejected to cooling water or to the atmosphere. The ALPHA system can recover over 70% of this energy that is otherwise wasted by generating low pressure steam from the hot concentrated sulphuric acid in the acid absorption circuit.

在传统的硫磺制酸装置中，所产生的热能约 70％的能量被回收利用，而余下的 30％热能多用冷却水带走或排放到空气中。该 ALPHA 系统可通过硫酸吸收回路产生的热强酸来产生低压蒸汽从而回收近 70%的所浪费的热能， 使得硫磺制酸装置中得总热回收率达到 90% 以上。

Application specific, between 0.4 and 0.5 tonnes of low pressure steam per tonne of acid can be generated in the ALPHA System. The low pressure steam, typically 7 bar(g), is particularly useful in fertilizer and mining complexes for process heating such as phosphoric acid evaporators, desalination plants and solvent extraction solutions.

具体应用中，ALPHA 系统每吨酸可产生 0.4 到 0.5 吨低压蒸汽。低压蒸汽压力通常设为 7 公斤，特别适用于肥料和采矿综合工艺中的加热过程，如磷酸蒸发器，海水淡化装置和溶剂萃取工艺。

The patented ALPHA System primarily consists of the following equipment:
——ALPHA Tower, a spray-type brick lined absorption tower, where hot SO_3 gas is absorbed into concentrated sulphuric acid.
——ALPHA Pump Tank, a pump tank where a submerged pump circulates acid to various equipment and dilution water is added to control the acid strength.
——ALPHA Boiler, a kettle type reboiler that utilizes the energy generated from the hot SO_3 absorption and the heat of dilution, to generate low pressure steam.
——ALPHA Boiler Feed Water Preheater, a shell and tube product-feed heat exchanger that preheats boiler feed water prior to steam generation.
持有专利的 Alpha 系统主要包括以下设备：
——ALPHA塔，喷雾型砖衬里式吸收塔，用于将热SO_3气体吸收为浓硫酸。
——ALPHA 泵槽，通过浸没式酸循环泵将硫酸循环至各个设备并通过稀释水的加入来控制酸的强度。
——ALPHA锅炉，釜式再沸式锅炉，利用吸收热的SO_3和稀释所产生的热能来产生低压蒸汽。
——ALPHA 锅炉给水预热器，管壳式换热器用于加热 ALPHA 锅炉给水。



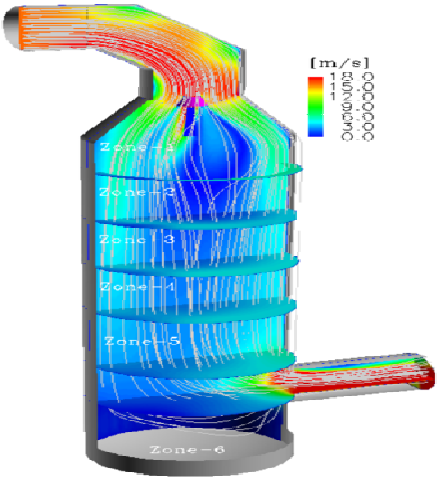
ALPHA System 3D Model

ALPHA 系统三维模型

ALPHA Installation at Lvling
绿陵 ALPHA 系统

The ALPHA system is an auxiliary system to the sulphuric acid plant, meaning that the sulphuric acid plant can operate independent of the ALPHA system. In the case of Lvling, ALPHA was added to an existing sulphuric acid plant to expand the production capacity of the plant from 400 mtpd to 600 mtpd. Integrating an ALPHA system into an existing sulphuric acid plant is an economically attractive method to expand the production of the sulphuric acid plant as the investment return period can be less than 2-3 years.

凯密迪所研发的 ALPHA 系统是硫酸装置的一个辅助系统，即硫磺制酸装置可以独立于 ALPHA 系统运行。在绿陵，ALPHA 系统被添加到现有的硫酸装置中，从而将工厂的产能由 400 MTPD 扩产至 600 MTPD。将 ALPHA 系统集成到现有的硫酸厂从而扩大硫酸装置产能是一个经济上很有吸引力的方式，投资回报期小于 2-3 年。



ALPHA System CFD Model
ALPHA 系统 CFD 模型

The materials of construction are of paramount importance to the operational reliability of ALPHA. During the development stages of ALPHA, an extensive corrosion test program was executed at Chemetics® Research and Development facility. Over 50 metallurgies were tested for corrosion resistance to hot and concentrated sulphuric acid under projected operating and possible upset conditions. Now, after six months of ALPHA´s continuous operation at Lvling, internal inspection and sonic thickness measurements have confirmed that the selected material, SARAMET HT®, can be successfully applied to an industrial scale. Saramet HT® is part of the SARAMET® family of materials developed by Chemetics for use in Sulphuric acid plants.

为保证 ALPHA 系统运行的可靠性，材料的选择非常重要。在 ALPHA 系统研发阶段，凯密迪就材料在正常操作及异常条件下在热浓硫酸的耐腐蚀性进行了大量的腐蚀试验， 对超过 50 种冶金方式进行了测试。现在，ALPHA 系统在绿陵连续运转半年后，内部检查和超声波测厚已确认所选的材料 SARAMET HT®可以成功地应用到工业规模。 Saramet HT®是凯密迪研发的用于硫酸装置的耐酸材料 SARAMET® 材料系列的一部分。

Maintaining the operation in the narrow window of sulphuric acid concentration (98.5-99.5%wt.) and temperature (185-205°C) are critical to ALPHA materials and operation. Therefore the main acid circulation contains redundant acid concentration analyzers and an on-line corrosion monitoring system that guards critical piping systems. These redundant instruments provide confidence to operators that the ALPHA System is operating in the correct operating window and increases the ease of operation.

保持操作中硫酸浓度（98.5-99.5％）和温度（185-205℃）的狭窄操作窗口是 ALPHA 系统操作及材料应用的关键。为此，ALPHA 系统的主酸循环回路设置了冗余酸浓度分析仪和一个在线腐蚀监测系统，来保护重要的酸循环管道系统。这些仪表的安装为操作员提供了 ALPHA 系统操作在正确的操作窗口的保证，并增加了操作的方便性。

A safety system continuously monitors the operation of the Alpha System. If this system determines that the ALPHA system is no longer operating within the safe operating region then an Emergency Dump Tank system is activated to protect the safety of plant operators in the unlikely event of a serious leak in the ALPHA Boiler.

ALPHA 装置由安全系统持续监视阿尔法装置的运作。如果该安全系统确定 Alpha 装置超出了安全操作范围，比如万一 ALPHA 锅炉泄漏，安全系统将激活紧急排放系统以保护工厂操作人员的安全。

Chemetics® ALPHA System at Lvling is a successful reference for increasing the energy recovery and production capacity in a sulphuric acid plant. Low corrosion rates of materials of construction have been demonstrated which are important for operational reliability. Redundant instruments and safety systems allow for safe operation and ensure that the system requires minimal operator attention.

凯密迪的 ALPHA®系统在绿陵的安装是提高硫酸装置能量回收和生产能力一个成功的参考。且证明所用材料的低腐蚀率， 这对 ALPHA 系统运行的可靠性非常重要。冗余仪表和安全系统保证了系统的安全运行，使得操作员的监控度最低化。

CHEMETICS®

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