

ANK 400

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U n p r e c e d e n t e d R u n L e n g t h s



**KUBOTA Corporation**  
1-24-47, Shikitsu-Higashi, Naniwa-Ku, Osaka, 556-8061, Japan  
<http://www.kubota.com>





# ANK400

## The Collaboration of Nova Chemicals and Kubota

Ethylene producers have long been concerned with coke formation in cracking furnaces. More than 10 years in development, "ANK400" addresses these concerns. ANK400 is new anti-coking cracking tube product that achieves an inner surface chemistry with a demonstrated ability to significantly reduce coking. NOVA Chemicals, Canada's largest ethylene producer, developed this proprietary technology using metallurgy from Kubota, who is now marketing ANK400 to the ethylene industry.

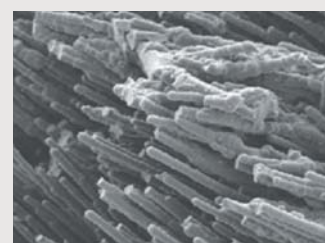
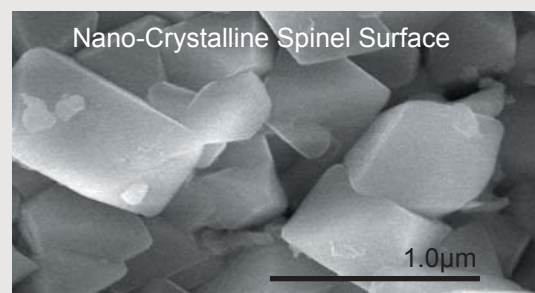


Cracking Furnace in Nova Chemicals

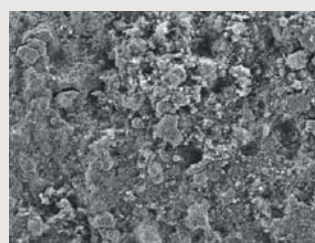


## Reduced Coke Formation – Increased Run Length with ANK400

ANK400 achieves unprecedented furnace run length by dramatically lowering coke formation. The key to coke reduction is an inert, nano-crystalline spinel surface which has been proven to reduce both catalytic and pyrolytic coking. This novel surface chemistry has increased run length by more than 10 times in multiple ethane crackers at NOVA's E1 and E2 plants in Joffre, Alberta.



Filamentous coke formed on the catalytic surface of untreated tubes.

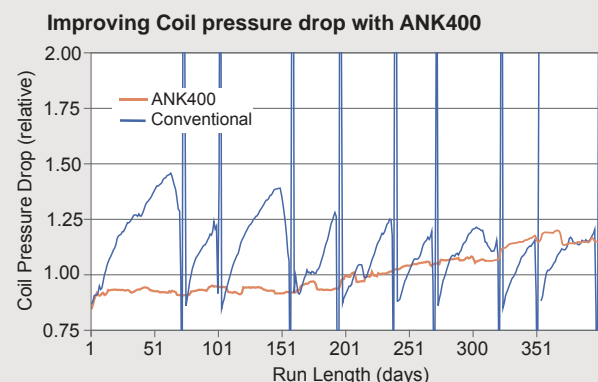
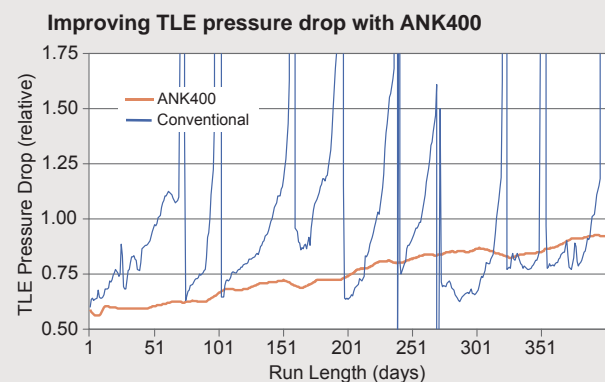


Dense coke formed on the inner surface of ANK400.

## 10 Times or More Run Length Is Achieved by ANK400

In the furnaces of Joffre Plant, coke forms and deposits on the radiant tubes and within the tubes of horizontal quench exchangers. Although there was significant coking in the radiant coils, the fouling of the quench exchangers limits the overall run length of the furnaces. As the result, average run length was only 30 days. On the other hand, after the furnace was installed with ANK400 in all passes of coil, coke formation was significantly reduced and run length was extended to over 400 days.

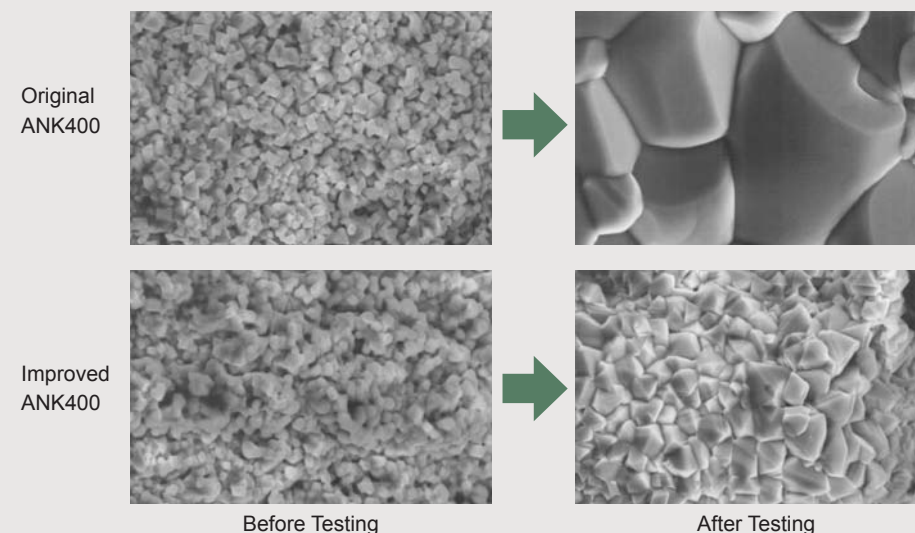
The increasing rate of both TLE and coil pressure drop for ANK400 coil is reduced to less than one-tenth of Conventional coil, because of significant reduction of coke formation by ANK400 technology. The reducing pressure drop increases ethane yields and maintains start of run energy efficiency longer.



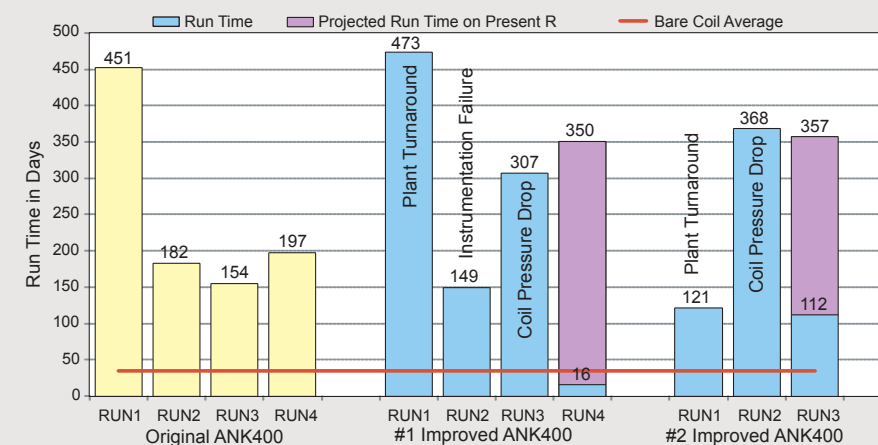
## Improvement of Spinel Surface Provide Stable Operation

At the early development stage, spinel surface was not steady for long term operation and thermal stability was not sufficient. The solution of this disadvantage is to increase the mechanical strength, robustness of the spinel layer, the resistance to thermal shock, creep damage and oxidation allowing the spinel layer to be subjected to higher temperatures and a border range of operating conditions. The results indicate that the improved ANK400 has higher thermal stability in the carbon rich environment of up to 1100 degree C. Improved ANK400 has been in commercial operation since January, 2006. It is expected to give good repeatability of excellent performance throughout the life of the coil.

### Oxidation Test Results (1100 degree C x 100hrs)



### Run Times Improved ANK400 and Original ANK400



## Operation Improvement Can Be Achieved by ANK400

Higher heat transfer, lower tube metal temperature (TMT), and reduced pressure drop in the coil have also been observed. The unique inner surface chemistry of ANK400 reduces coke formation not only in the cracking tubes, but also down stream, in the transfer line or primary quench exchanger. The coke which forms in ANK400 furnaces is dense and uniform, and thus does not cause fouling in these critical areas, greatly improving furnace reliability while reducing maintenance. Sulphur additions, to control catalytic coke formations and CO formation, have also been lowered due to reduced overall coke and CO formation.

The unique surface chemistry of ANK400 has been achieved using Kubota's heat resistant family of alloys. These alloys have demonstrated their durability in the most severe ethylene crackers for over 50 years. The combination of the operational experience, research and development strength, and world wide reputations of NOVA Chemicals and Kubota ensure that ANK400 can reliably increase your bottom line in ethylene.

### Supply List of ANK400

As of Jun. 2014

Furnace Type	No. of Installation
SRT-I	5
SRT-II	1
SRT-III	11
SRT-IV	0
SRT-V	1
SRT-VI	0
Millisecond	2
M-coil	6
W-coil	7
Selas	15
FW	47
Other	27
<b>Total</b>	<b>122</b>