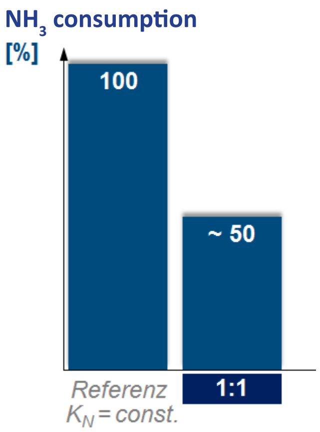
STANGE
ELEKTRONIK GMBH

Ammonia Reduction up to 50%
by NITRO-PULS©



NITRO-PULS©

New proven sensor-controlled gas nitriding technology

STATE OF THE TECHNOLOGY

Ammonia is used as nitrogen dispenser for gas nitriding. The ammonia reacts at nitriding temperature at the catalytic acting metallic surface in the treatment chamber due to thermal causes in nitrogen and hydrogen. The degree of dissociation of ammonia or the hydrogen content in the furnace atmosphere defines the nitriding effect of the process gas and is specified by the nitriding potential Kn. But only 5 up to a maximum of 10% of the used ammonia react on the active surface in the treatment chamber. The rest of the process gas is unused and usually flared.

In industrial practice gas nitriding processes run with constant set gas quantities or gas potential during holding time. Set values can be changed empirically in several steps during holding time. This practice leads above all to a high NH3 consumption in the run-up nitriding phase with high nitriding potential. But even in the following segments of the holding time the gas consumption is very high with constant set values.

NITRO-PULS© TECHNOLOGY

The utilisation factor could be improved considerably by pulsating and/or time-dependent, cyclic variable nitriding potentials. The setting of the required compound layer phase structure was reached by time-dependent variation of the nitriding potential and the gas flow. This new gas nitriding technology NITRO-PULS© was developed together with the Institute of Materials Engineering TU Bergakademie Freiberg.

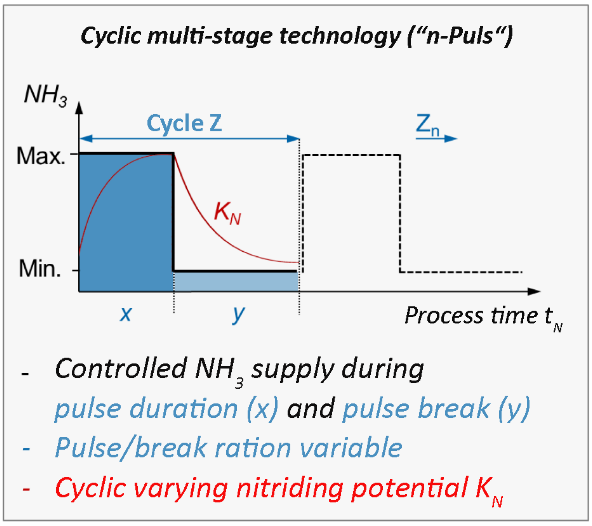
For the NITRO-PULS© technology a new control concept of a temporal variation of nitriding potential Kn on basis of a change of the H2 sensor signal was introduced. The temporal variation takes place after the pulse length as well as the pulse break.

Our control concept was successfully tested in practice. The evidence was provided that our concept fulfils the practical requirements.

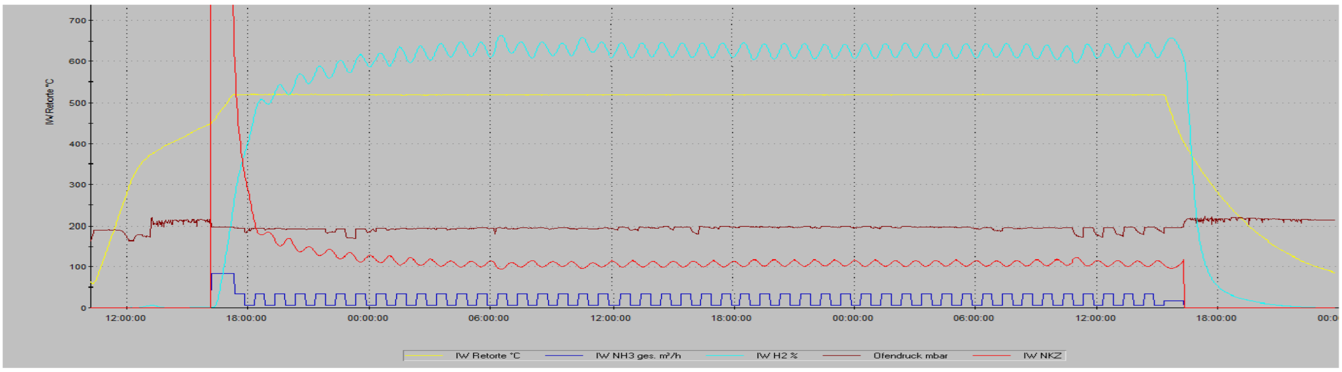
NITRO-PULS© CONTROL CONCEPT

A modified control algorithm was realized for the implementation which was reviewed and developed further in test programs.

In this way the optimizing of the switching behaviour between fixed quantity control and nitriding potential control in the holding phase was made possible. The reference variable for the nitriding potential control is the NH3 quantity. Switching to the holding phase takes place according to the NH3 actual value from the fixed quantity control. The nitriding potential control loop is set to the currently available furnace atmosphere and then leaded to the set value moving in a very short time. Thus event depending batch sizes, batch surfaces and a batch activity control of the nitriding atmosphere were possible.

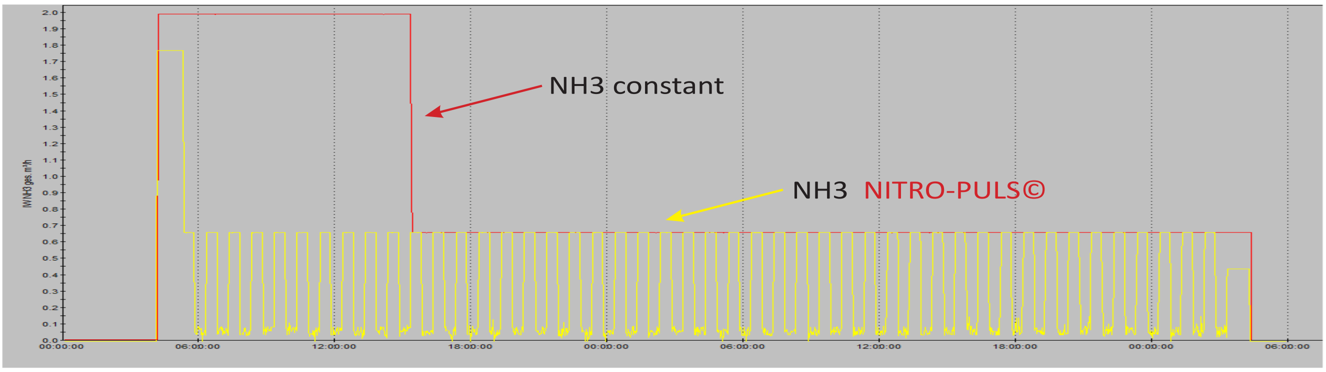


NITRO-PULS© technology in practical test: NH3 saving 39%



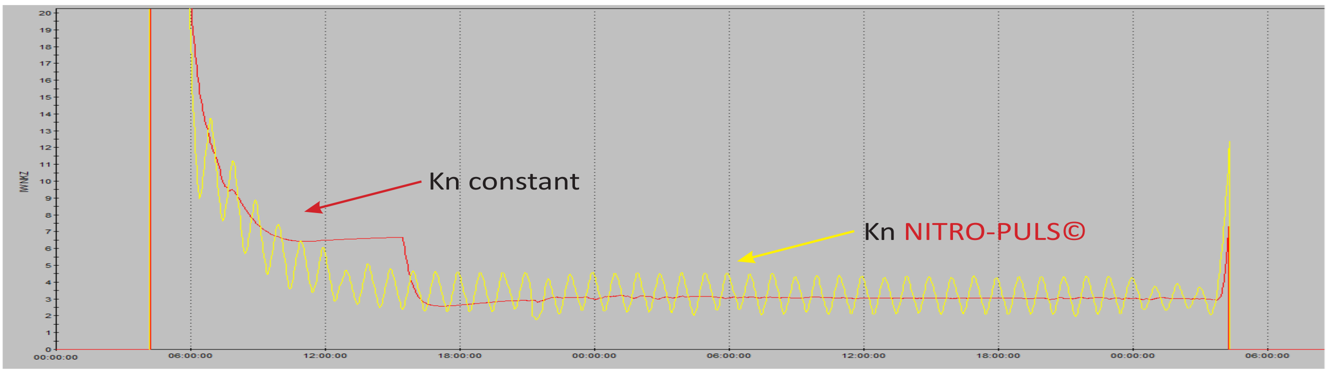
- Practical test at a holding temperature of 515°C, holding time: 48 hours
- Save nitriding results reached by pulse/holding time: 30 minutes
- 2 hours run-up nitriding phase with a bigger NH3 quantity
- 46 hours holding time with a smaller gas quantity pulsed
- The minimisation of NH3 quantity during the holding time makes further 10% saving possible
- Nevertheless pulsed gas quantity the furnace pressure is almost constant

Batch comparison NH3 quantity constant and NITRO-PULS©: NH3 saving 61%



- Further practical test: NH3 quantity significantly reduced in the holding phase
- NH3 saving of 61% in comparison to reference program with constant gas quantities

Batch comparison nitriding potential constant and NITRO-PULS©



It was recognised that a quantity reduction in the first phase (11 hours) with constant gas quantities is definitely reachable. In this comparison of the nitriding potential the run-up nitriding phase can be reduced to 2 hours.

In all practical tests the required parameter like CLT, NHD and case hardness were met.

STANGE
ELEKTRONIK GMBH

YOUR CONTACT PERSON
Dipl.-Ing.
Stefan Heineck
Department process technology

STANGE Elektronik GmbH
Office Thuringia
Wandersleber Str. 1b
D-99192 Apfelstädt
Fon: + 49 - 36202 - 75090
Fax: + 49 – 36202 - 750991
Email: sheineck@stange-elektronik.de

Gefördert durch:

Bundesministerium
für Wirtschaft
und Energie

aufgrund eines Beschlusses
des Deutschen Bundestages

In collaboration with the Institute of Materials Engineering TU Bergakademie Freiberg

TU BERGAKADEMIE · FREIBERG ·
TECHNISCHE UNIVERSITÄT
BERGAKADEMIE FREIBERG
Die Ressourcenuniversität. Seit 1765.

STANGE Elektronik GmbH
Rudolf-Diesel-Str. 15-17
D-51674 Wiehl
Fon: + 49 - 2261 - 95790
Fax: + 49 - 2261 - 55212
Email: info@stange-elektronik.de
Internet: stange-elektronik.com