

V Strength

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Published Research Does Not Support Genotoxic Mode of Action for V₂O₅

Three important new studies were supported primarily with public funds from the US Department of Defense and the US Food & Drug Administration and involved animal studies specifically designed to address data gaps in the knowledge of Vanadium Pentoxide in response to a draft US EPA Assessment.

The new studies were designed to use the best available technologies to assess direct DNA effects from V₂O₅, used the relevant route of exposure (inhalation), the relevant species (mouse), the relevant strain (B6C3F1), and were conducted by experienced and renowned investigators and laboratories.



A 2001 study on V₂O₅, conducted by NTP, showed a significant increase in lung tumors in B6C3F1 mice following chronic exposure however, there was no significant increase in lung tumors in F344N rats at similar exposure levels. Levels were very high and caused inflammatory lesions in all animals and unfortunately were close together complicating interpretation regarding public health at lower exposure levels. The NTP study has been criticized in a published paper, however in the absence of other data, EPA selected the category of "likely human carcinogen." These new studies were specifically designed to test that hypothesis.

Because of the concern that vanadium pentoxide might be directly mutagenic, a state of the art transgenic study was performed in the mouse. In addition, they specifically looked for Kras mutants in the lung tissue to see if these were directly formed by vanadium pentoxide. Both of these studies were negative and did not support a mutagenic mode of action.

**Mutation Research/Genetic Toxicology and Environmental Mutagenesis**
Volumes 789–790, August 2015, Pages 46–52



Evaluation of *cII* mutations in lung of male Big Blue mice exposed by inhalation to vanadium pentoxide for up to 8 weeks

Mugimane G. Manjanatha^a, Sharon D. Shelton^a, Lynne Haber^b, Bhaskar Gollapudi^c, Judith A. MacGregor^d, Narayanan Rajendran^e, Martha M. Moore^{a,1}

**Mutation Research/Genetic Toxicology and Environmental Mutagenesis**
Volumes 789–790, August 2015, Pages 53–60

Quantification of *Kras* mutant fraction in the lung DNA of mice exposed to aerosolized particulate vanadium pentoxide by inhalation

Malathi Banda^a, Karen L. McKim^a, Lynne T. Haber^{b,1}, Judith A. MacGregor^c, B. Bhaskar Gollapudi^d, Barbara L. Parsons^a

**Regulatory Toxicology and Pharmacology**
Volume 73, Issue 1, October 2015, Pages 339–347

Using gene expression profiling to evaluate cellular responses in mouse lungs exposed to V₂O₅ and a group of other mouse lung tumorigens and non-tumorigens

Michael B. Black^a, Darol E. Dodd^a, Patrick D. McMullen^a, Sali Pendse^a, Judith A. MacGregor^b, B. Bhaskar Gollapudi^c, Melvin E. Andersen^a

The gene expression study, also in B6C3F1 mice following inhalation exposures at a level that was positive in the NTP study, was conducted in lung tissue and determined that no human biological pathways were activated by vanadium pentoxide at inflammatory levels.

All three studies were sent directly to the US EPA for their review, consideration, and hopeful integration into their final assessment of V₂O₅.

“China continues to be a critical market for vanadium products so Vanitec’s commitment to the VANITEC-CISRI Vanadium Technology Centre is an important asset for our members.”

- David Milbourn, CEO

Pangang Hosts High Strength Seminar

A joint meeting of the 2nd Development and Application of Vanadium and Titanium Microalloyed High Strength Steels Technical Seminar 2015 Annual Meeting was held at NEU (Northeastern University) International Hotel in Shenyang, China on 29 September 2015.

The meeting was attended by near 100 representatives from Chinese steel works, automotive companies, research institutes, universities and government, including BaoSteel, AnSteel, Shougang, Pangang, Chenggang, FAW, China National Heavy Duty Truck Group, CISRI and China Iron and Steel Association, etc.

At the meeting, 16 experts presented their works on development and application of vanadium and titanium steels, especially microalloyed non-QT steels.

Prof. Yang Caifu of the Vanitec-CISRI VTC delivered a keynote on worldwide research and use of vanadium microalloyed Steels in recent years. Mrs Wang Ruizhen of CISRI presented her group work on “Weldability of Vanadium-Bearing Steels”, which is supported by Vanitec.

During the meeting, China Vanadium Association held the “Second Vanadium

Containing Steel Outstanding Paper Award” ceremony and gave the award to five authors. Mr Yang Xiongfei of Pangang is one of the award winners.

The main objective of this seminar is to promote research on development and application of vanadium and titanium steels in China and provide a platform for technical exchange.



Vanadium Technology Centre Update

Vanitec-CISRI partnership continues to deliver research and promotion in China.

Niobium microalloying has been commonly used in production of medium and heavy steel plates. The project “Study on vanadium microalloyed steels for shipbuilding with high heat input welding” was supported by Vanitec and undertaken by CISRI, in some extent to push the application of vanadium microalloying technology in these plates. From the point of improving HAZ toughness under high heat input welding, the study has compared the HAZ toughness of the steels with different microalloying systems of Nb-Ti, V-Ti and V-N-Ti.

The study has shown that different microalloying systems have distinct effects on HAZ microstructures, as well as resulting HAZ toughness. It is concluded through



comparison experiments that the V-N-Ti system with appropriate N content is more suitable for high heat input welding.

Application of this technical concept in heavy plate with higher carbon content for offshore platform has achieved good results. This study will be of instructive significance in alloy design of high-strength low-alloy structural steel plate for other application purposes with high heat input welding conditions.

The Vanitec-CISRI Vanadium Technology Center also strengthened actively technical exchanges and publicity of vanadium technology.

This year, the VTC has visited the following steel companies and customers: Laiwu-Steel, Baotou-Steel, Tangshan-Steel, Inner Mongolia North Heavy Industries Group Co., Ltd, Jiangsu Xuzhou Construction Machinery Group, Dongfeng Automobile Co., Ltd and others.

Meanwhile, to help the scientists, technicians, and users from the Chinese steel industry better understand the latest development of R&D and application of vanadium technology, the VTC translated the books “The Role of Vanadium in Microalloyed Steels” and “Vanadium Microalloyed Steels: A Symposium in Memory of Michael Korchynsky” into Chinese, which were published in 2014. The Chinese versions can be expected to meet with readers during the year.

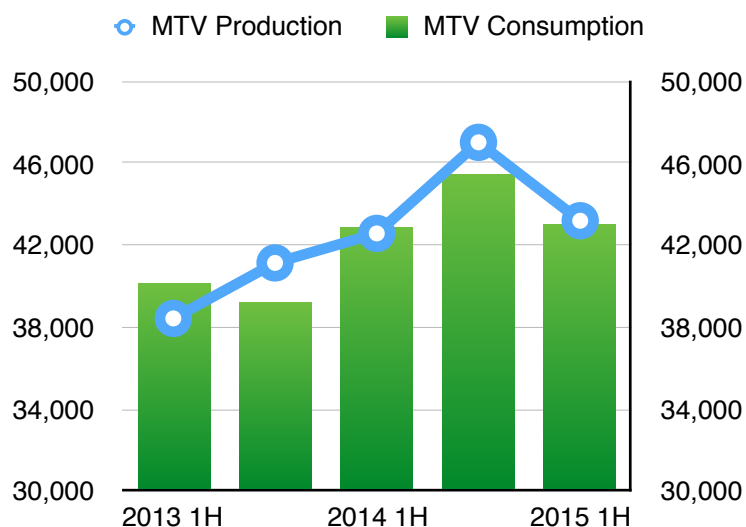
V Production & Consumption Lower

Worldwide commodities slowdown affecting V industry as well.

In its reporting, Vanitec defines vanadium production as MTV in all oxides produced, plus MTV in other V-compounds not produced via oxide route, plus MTV FeV not produced via V₂O₅-route.

The data is not disseminated by Vanitec nor used for any purpose other than compiling overall statistics for the vanadium industry.

Detailed information such as individual region production and consumption and specific consumption rates are available to Vanitec members only. If you are interested in joining Vanitec as a full or associate member please contact us at info@Vanitec.org.



Vanadium Award

The Vanadium Award for 2014 was won by Shahrooz NAFISI of EVRAZ Research and Development, Canada; Muhammad ARAFIN of McGill University, Canada; Robert GLODOWSKI of EVRAZ, East Metals North America, USA; and Jerzy SZPUNAR of University of Saskatchewan, Canada for their paper "Impact of Vanadium Addition on API X100 Steel", published in ISIJ International, Vol. 54 No. 10, 2014, pp. 2404–2410.

The paper highlights that addition of 0.06%V to an API X100 Steel resulted in an increase of both yield and tensile strength of 60 to 95 MPa for all the tensile testing samples taken at different angles from the rolling directions. However, the Charpy toughness and elongation results were nearly identical for the steels with and without the vanadium addition. It concludes that vanadium addition is necessary to ensure meeting the required strength properties for API X100 steel.

Members

AMG Vanadium, Inc.

Bear Metallurgical Company

Beijing Zhongkaihongde Technology Company

Chengde Iron & Steel Group Co Ltd

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Evraz Highveld Steel & Vanadium Limited

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Evraz Stratcor, Inc.

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Neometals Limited

New Zealand Steel Ltd.

Panzhuhua Iron & Steel Group

Treibacher Industrie AG

VandiumCorp Resource Inc.

Vanchem Vanadium Products (Pty) Ltd.

Australian Vanadium Ltd.



UPCOMING EVENTS

89th Vanitec Projects & Publications Panel Meeting

London, UK
7 April 2016

90th Vanitec Meeting

Chengdu, China
April 2016

1st International Conference on Automotive Steel

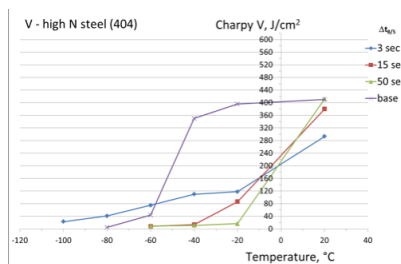
Chengdu, China
16-18, Dec. 2016

For further information continue to check out our website at www.vanitec.org.

Swerea Kimab - Vanitec Research Shows Promise

Two Vanitec sponsored projects are nearing completion at Swerea Kimab in Stockholm, Sweden, and both provide encouraging results for the potential use of vanadium in new applications.

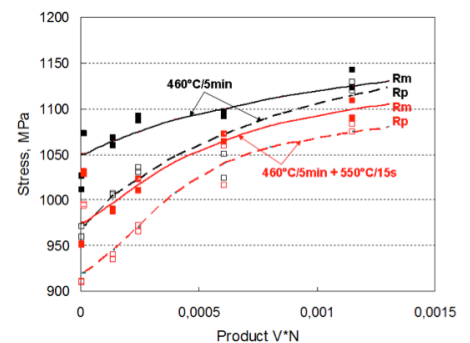
The heat affected zone (HAZ) toughness of V-N microalloyed steels after simulated low heat input welding has been investigated. As shown in the figure, the HAZ impact transition temperature improves as the heat input is reduced to levels characteristic of new low heat input welding techniques such as laser hybrid arc welding. High acicular ferrite content in the HAZ microstructure has been observed and this explains the improved toughness after faster cooling. CTOD testing is ongoing as well as further work to explain the observations.



swerea | KIMAB

Another project has investigated the use of V and N as microalloy additions that retard softening in high strength martensitic strip steels subjected to hot dip processing. As the figure shows, the combined additions of V and N have been found to increase strength after simulated galvanizing and galvannealing, when compared with steels containing no V.

Further work is now ongoing to optimize the carbon content and VN product, and also to investigate the effect of Al, which has been found to reduce the effectiveness of N.



Vanitec Sponsors HSLA 2015 Conference



The joint conference of the 7th International Conference on High Strength Low Alloy Steels (HSLA Steels 2015), the International Conference on Microalloying 2015 (Microalloying 2015) and the International Conference on Offshore Engineering Steels 2015 (OES 2015) co-organized by The Chinese Society for Metals (CSM) and Chinese Academy of Engineering (CAE), was held in Hangzhou, China on 11-13 November 2015. The conference focused on the exchange of the latest scientific and technological progress on HSLA steels,

microalloying steels and offshore engineering steels over the past decades, strengthen cooperation between universities and research institutes, iron and steel production companies and users, and promote the further development on the fields all over the world.

Vanitec was a main sponsors and CISRI helped organize the conference. Vanitec supported the speakers in China and overseas to present 19 papers related to development and application of vanadium microalloyed steels at the conference.

Vanitec



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Vanitec is a technical and scientific committee (The Vanadium International Technical Committee), which brings together representatives of companies and organisations involved in the mining, processing, manufacture, research and use of vanadium and vanadium-containing products.

The objective of Vanitec is to promote the use of vanadium bearing materials and thereby to increase the consumption of vanadium across the range of steel, titanium and chemical applications.

Vanitec strives to provide those with a vested interest in Vanadium – users, educators, students, producers – convenient access to research, events, resources and publications regarding Vanadium.