



Annual report 2009

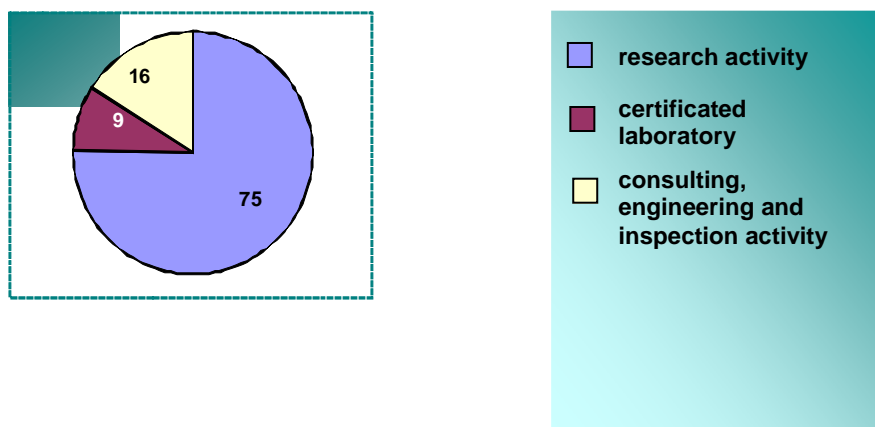
Activities of company

SVUOM Ltd., a private company pursues research, development, consulting, testing, expert accounts, inclusive environmental ones, and other activities according to the demands of its clients. SVUOM Ltd. was founded in 1999 and it continues in research, testing, consulting and inspection activities of State Research Institute of Protection of Materials (1952 -1994).

The SVUOM Ltd. creates and implements research results within the fields of materials, process, products and production technologies from point of view of degradation, corrosion and corrosion protection. The international collaboration takes place with other institutes, universities, academia or companies where the EU programmes dominate.

SVUOM revenues come from a number of different sources:

- ▶ commercial activities - R&D activity for industry, testing, laboratory assessment, expertising, inspection,....SVUOM Ltd. has many customers, a clear majority of them are small and medium-sized companies which cannot perform their own research resources.
- ▶ testing of climatic and corrosion resistance and physic-mechanical properties of materials and coatings in laboratory accredited according to EN ISO/IEC 17 025
- ▶ technical standardization – since 2009 SVUOM Ltd. had been licensed by the Czech Office for Standards, Metrology and Testing (ÚNMZ) as Centre for Technical Standardisation in the field of corrosion and corrosion protection,
- ▶ publication and lecturing,
- ▶ national projects – publicly financed long-term basic and applied research, primary initiated by the Ministry of Education, Ministry of industry, Czech Science Foundation, etc.,
- ▶ EU projects - R&D commissions for which financing is shared between the EU, industry and other research institutes.



Turnover per subsidiary - 2009

R&D projects and programmes

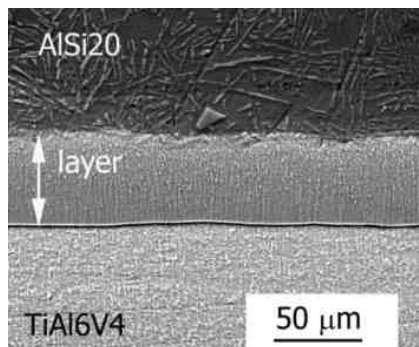
The national programmes represent around per cent of activities of SVUOM Ltd. There are major multi-year programmes initiated mainly by the Czech Science Foundation, Ministry of Education, Ministry of Industry, etc., which concerns long-term basic and applied research and provide contacts between institutes, universities and industry.

The information of projects can be found on e.g. www.atmofix.cz, www.bestproduct.cz or www.svuom.cz.

In 2009 SVUOM realized and participated on these projects:

VZ MŠMT 2579478701 Study of methods for specification of prediction of service life of metallic materials and their protective coatings in respect to effect of pollute compounds for environment (2004 - 2010)

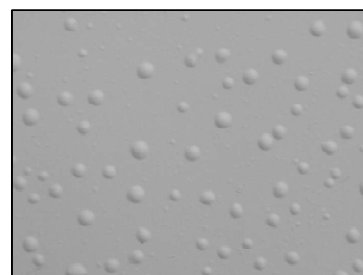
The solving of project was orientated onto study of some new types of surface treatments – e.g. layer prepared by liquid siliconizing by Al-20wt%Si composed from ternary phase τ_2 ($Ti(Al_xSi_{1-x})_2$). Liquid-phase siliconizing was presented as simple and effective method for preparing of protective layers on titanium alloys for high temperature application of component which are not exposed to high stress application.



The effect of specific industrial pollution to structural metals' atmospheric corrosion in microclimates was studied. The different methods of corrosion rate prediction were compared – mathematical equation based on environmental data and artificial neural network model. The atmospheric corrosion test in specific polluted industrial environment was performed – the corrosivity can significantly differ on relative small area. This effect is not possible to predict by standard methods.



Other activity was concern to long-term degradation of organic coating at field tests and in real applications and method of prediction of their behaviour based on the results of accelerated corrosion tests. Natural weathering is not a controlled process and depends on climatic zone, yearly seasons and many other environmental factors. The degradation mechanisms in accelerated tests are different from real atmospheric condition and results into such defects which does not occur at real atmospheric conditions of the Czech Republic or central Europe region, e.g. blisters forming.



GA ČR 104/07/1637 Study of factors affecting properties and degradation mechanisms of organic coatings (2007- 2009)

The aim of project is studying of the selected degradation mechanisms of coatings. The porosity of coating is one of significant factor of its degradation.



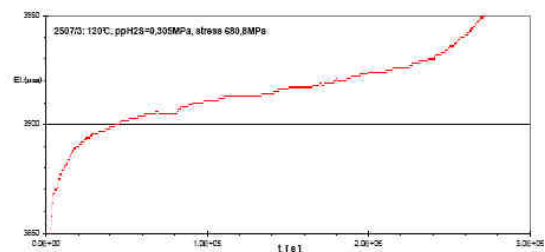
The other task of the project is the elaboration of laboratory test methods to eliminate non-suitable types of high-solid coatings which could be degraded by diffusion high boiling compounds into

atmosphere. The special vacuum equipment had been assembled and samples of high-solid coatings tested in this method. Exposed coatings were analysed.

CV method application for the rapid screening of inhibition efficiency of different commercial pigments powder solution extracts on carbon steel susceptibility to pitting and localised corrosion was verified. For testing were used extracts without as well with the addition of NaCl. The chosen method seems to be able to identify the potential susceptibility of carbon steel to pitting and localised corrosion for each of tested environments.

GA ČR 106/08/1789 Degradation mechanisms of cold worked stainless steels in aggressive environments (2008 - 2010)

The stainless steels' corrosion mechanisms was tested - modelling of stress corrosion crack growth in duplex stainless steels (DSS) during SSRT experiments in hydrogen sulfide – chloride environments at 120°C and hydrogen sulfide – chloride environments at 120 and 80°C.



MPO FR-TI1/274 (2009 – 2012) Evaluation of SHM methods and its integration into aircraft maintenance system

This project is realized in co-operation with Honeywell International s.r.o. as coordinator and Aircraft Industries, a.s., Institute of Thermomechanics AS CR and Faculty of Mechanical Engineering of Brno University of Technology together with SVUOM Ltd.

The aim of the project is R&D of a new technology for monitoring of airframe structure critical parts degradation due to material fatigue and corrosion development. Sensors permanently

attached to critical airframe parts will be used. Critical airframe parts, type of fatigue cracks and corrosion relevant for selected parts will be defined, and sensors and methods for their monitoring will be identified.

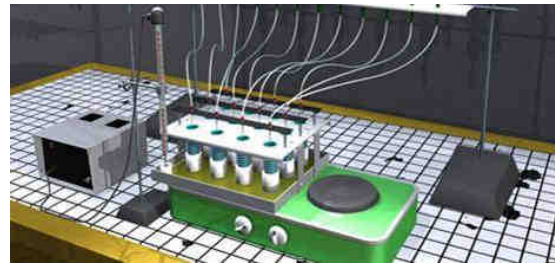


MPO FT-TA4/095 Changes of rubber lining quality and monitoring methods due to service-life (2007 - 2010)

The project is realized in co-operation with Institute of Chemical Technology in Prague.

Research, of rubber coatings used for corrosion protection of industry technology under the destructive environment, monitoring of parameters which have describe changing of properties, during these lifetime and the suggest of process leading to improve on prediction of lifetime on the base of laboratory and industry operation (in-situ) measurement under different condition of destructive impact and cut back users expense.

The database of investigating rubbers coatings will be realize with consideration on suitable application for specific conditions of industry technology, including prediction of lifetime data.



MPO FT-TA5/076 Study of existing and newly developed weathering steels in respect to their usage for steel structures (2008 - 2010)

The project aim is the analysis of the stage of the existing steel structures made from weathering steels exposed for long-period in various environments. During year 2009 ca 20 long- and short-term exposed constructions made from weathering steel had been evaluated – the thickness and analysis of patina, residual steel thickness and causes of failure of protective patina had been recorded.



Decreasing corrosivity of the Czech Republic atmospheres results in significantly lower one-year corrosion mass loss of weathering steel. The very quickly response of structural metals on changing corrosivity it can be expect the similar behaviour of weathering steel on real structures.

The most negative effect on protective layer forming has such detail as deck drainage system (scuppers, troughs, etc.) on bridge structures. In cases that precipitation containing de-icing salts leaked on weathering steel surface and destroyed the protective ability of patina layer.

The output of project will create the base for actualisation of technical standards, elaboration of software and maps for prediction of service life of weathering steels for new built and for existing structures.

MPO FR-TI1/560 Optimisation of production and operating conditions for galvanized tubes used for indoor water distribution system (2009 - 2011)

After ca 2 years of using the serious corrosion failure occurs in hot dip zinc coated tubes for hot water distribution. Project studies the mechanisms of this corrosion attack in relation to chemical composition of water and other factors. The analysis of corrosion layers of damaged tubes shows mainly hemimorphit $Zn_4Si_2O_7(OH)_2 \cdot (H_2O)$. The tests of water chemistry onto zinc corrosion rate at different temperatures had been performed.



The international programmes, primarily within the European collaborative venture, give SVUOM specialists the opportunity to share the latest progress in the field of corrosion and corrosion protection research – new materials, technologies, methods of evaluation, etc. This also applies to international standardisation contexts where SVÚOM is an active participant.



UN/ECE ICP on Effect on Materials Including Historic and Cultural Monuments (since 1986)

Upon the Convention on Long-range Transboundary Air Pollution the *International Co-operative Programme on Effects on Materials, including Historic and Cultural Monuments* is realized since 1986. Contemporary 15 European countries participate on this project and 24 test sites are included in Europe.

The aim of the Programme is to perform a quantitative evaluation of multi-pollutant effects on atmospheric corrosion, including effects of sulphur pollutants in combination with NO_x , ozone and other pollutants. Both technically important materials and materials used in historical and cultural monuments are involved.

SVUOM participates as sub centre for structural metals and corrosivity trends. The work of the sub centre represents the periodical evaluation of the corrosion effects, statistical analyses for corrosion effects and environmental variables, trend

analyses, quantitative evaluation of the effect of pollutants on the atmospheric corrosion of structural metals.

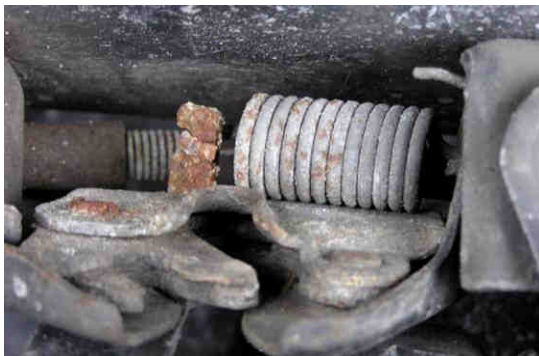
In 2009 the new exposure of structural metals and other basic materials had been finished and the trends in changes of air pollution, atmospheric corrosivity and the effect on materials had been estimated.



BESTPRODUCT - TENEEEST Through a European Network on Environmental Engineering Sciences and Technologies (Σ! 3517 Eureka) (2007 - 2010)

This project aims to concentrate capacities, expertise and know-how by clustering researchers, engineers and industrialists involved in environmental engineering. This network will allow the creation of a virtual competence centre in which information and know-how can be shared so that environmental engineering especially in the life cycle prediction methods will improve and that new engineers and researchers can be trained in that technology.

In this project SVUOM Ltd. Participates with Czech Technical University, Faculty of Electrotechnology on study of various methods of accelerated tests, mechanisms of long-term degradation of materials and surface treatments, etc. in various operating conditions. The results of some solved problems had been published in special guidelines.



A special task in frame of this project is protection of industrial cultural heritage. With the progress of technical development many technical objects and industrial sites become to be a part of cultural heritage. There is an increasing aim to preserve them. Atmospheric corrosion of metals and deterioration of protective coatings is problem. It is lack of knowledge how to apply the modern technologies of corrosion protection and effective corrosion protection with to respect to requirements of the monument care and take advantage of conservation approaches.



Centre of technical standardisation

Technical standards are an important part of technology base for products, equipment, infrastructure, energy production and distribution and many other areas.

With the organization changes of Czech Standardisation body the SVUOM created the Centre of technical standardisation since 1.1.2009. This Centre is responsible for international co-operation in standardisation in the field of corrosion and corrosion protection as well as co-operate on national level with many specialists for technical praxes. In year 2009 35 new or revised standards for corrosion and corrosion protection had been published.



Colaboration with colleges, universities and other bodies

A wide range of contacts has been built up since many projects involve collaboration with the academic world as well as industry. SVUOM Ltd., and/or its employees personally, take part in national and international networks with colleges, universities, institutes, companies, and other bodies in various fields of activity.

SVUOM's specialists co-operate with universities (e.g. VSCHT Prague, CVUT Prague, VŠB-TU Ostrava, TU Bratislava, VŠ Košice) in frame of research projects and as lectors in various type of postgraduate and special courses (ERASMUS projects). Some students of technical universities elaborated their diploma studies and papers under supervision by SVUOM's specialists.

SVUOM and its specialists are members of European Federation of Corrosion (EFC), NACE International (National Association of Corrosion Engineers), Association of Corrosion Engineers (AKI) Association of Museums' Specialists (AMG). In the field of corrosion problems and corrosion protection SVUOM's specialists co-operated with many associations (Czech Association for Galvanizing, Czech Society for Surface Treatments, Czech Association of Scientific and Technical Societies).

Awards



European Federation of Corrosion

The European Corrosion Medal is award to recognise achievements by a scientist, or group of scientists, in the application of corrosion science in the widest sense and is given every two years preferably on the occasion of a European Corrosion Congress (EUROCORR). In 2009 (6-10 September 2009, Nice) the laureate of this medal was **Prof. Ing. Vladimír Číhal, DrSc.** (SVUOM Ltd., VŠB-TU Ostrava). Prof. V. Číhal gave a lecture *The role of titanium in stainless steels* related to his work for which the medal was attributed.



Publications

In 2009 SVUOM's specialists presented results of their research on many national and international conferences and in national and international journals, e.g.:

- J.Benešová, M.Paráková, H.Geiplová, Affecting coating adhesion by thickness of the steel substrate, 23th Conference Surface treatment, Havlíčkův Brod, 5-6. listopad 2009
- J.Benešová, M.Svoboda, J.Jarušek, Problems of testing of paints which are used for the protection of steel constructions in the atmospheric environments and possibility of the prediction of their behaviour in atmospheric conditions based on the results of laboratory tests, 40th International Conference on Coatings technology, May 18-20 2009, Pardubice Czech Republic ISBN 978-80-7395-176-4
- V.Číhal, The role of titanium in stainless steels, proceeding of EUROCORR 2009, 6-10.9.2009, Nice
- B.Eremias, V.Cihal, E.Kalabisova, Analysis of hydrogensulfide effects on SCC susceptibility of duplex stainless steels in hydrogen sulfide-chloride environments at 160°C and application of slip-dissolution model of stress corrosion crack growth, proceedings of EUROCORR 2009, 6-10.9.2009, Nice
- M.Kadlecová, V.Číhal, E.Kalabisová, Evaluation of corrosion resistance on stainless steels and titanium in HNO₃, Ochrana przed korozja, 11/2009, 52, ISSN 0473-7733, 14th Corrosion Symposium,, New Achievements in Corrosion Research and Engineering", Jastrzab-Poraj, Polan, 25-27th November 2009, str. 574
- E.Kalabisová, T.Kubatík, J.Racek, M.Kadlecová, K.Kreislová, V.Číhal, Corrosion of aluminium construction in wood-driven environment, Ochrana przed korozja, 11/2009, 52, ISSN 0473-7733, 14th Corrosion Symposium,, New Achievements in Corrosion Research and Engineering", Jastrzab-Poraj, Polan, 25-27th November 2009, str.

- K.Kreislová, A.Lomozová, Vliv kvality provozních kapalin na korozi, 2. odborný seminář Kvalita ve výrobě, 1. - 2.4.2009, Čejkovice, ISBN 978-80-254-4182-4, pp. 74 – 79
- K.Kreislova, A.Lomozova, J.Benesova, Accelerated corrosion tests for simulating of de-icing salt's effect, ETE 2009 Second EUREKA symposium, 7.5.2009, Brusel
- K.Kreislová, P.Žák, Základní vlastnosti elektrolytických povlaků ovlivňujících jejich korozní odolnost a funkčnost, sborník přednášek 51. Mezinárodní galvanické konferenci, 16.-17.6.2009, Gabčíkovo, SR, ISBN 978-80-227-3098-3, str. 26 – 34
- K.Kreislová, H.Geiplová, J.Benešová, A.Lomozová, A. Kupílková, Příčiny snížení životnosti kontinuálně lakovaných plechů, Konstrukce, ISSN 1213-8762, Vol. 8, No. 3, 2009, str. 7- 15
- D.Knotková, K.Kreislová, A.Švec, I.Kudláček, P.Žák, Ochrana kovových technických památek proti atmosférické korozi, sborník Konference konzervátorů-restaurátorů, 8.-10.9.2009, Hradec Králové, ISBN 80-86413-62-4, ISSN 1801-1179, str. 17-21
- K.Kreislova, D.Knotkova, V.Krivy, J.Podjuklova, The effect of differentiated exposure conditions on corrosion behaviour of weathering steel on bridges, proceeding of EUROCORR 2009, 6-10.9.2009, Nice
- V. Křivý, L. Rozlívka, K. Kreislová, Zkušenosti a poznatky z chování dlouhodobě exponovaných mostů z patinujících ocelí v České Republice, sborník 22. Konference Ocelové konstrukce a mosty 2009, 23. – 25. 10. 2009, Brno, ISBN 978-80-7204-635-5, str. 151
- D. Knotková, K. Kreislová, L. Rozlívka, V. Křivý, J. Podjuklová, Hodnocení vrstev patin na konstrukcích z patinujících ocelí, sborník 22. Konference Ocelové konstrukce a mosty 2009, 23. – 25. 10. 2009, Brno, ISBN 978-80-7204-635-5, str. 133
- T.Kubatík, M.Jágllová, E.Kalabisová, V.Číhal, The effect of heat treatment on the microstructure of surface layers prepared by liquid-phase siliconizing and its influence on oxidation resistance of TiAl6V4, 15th Asia Pacific Corrosion Control Conference, Manila, Philippines, October 18 to 21, 2009
- T.Kubatík, M.Jágllová, E. Kalabisová, V.Číhal, Silicide-aluminide ternary protective layers on TiAl6V4 alloy prepared from Al-Si alloy as solid phase on TiAl6V4 substrate, 14th Corrosion Symposium „New Achievements in Corrosion Research and Engineering” Poraj, Poland, November 25-27th, 2009
- A.Lomozová, K.Kreislová, Vliv teploty a složení vody na korozi žárově zinkovaných trubek, sborník XV. konference žárového zinkování, 6.-8.10.2009, Sliach, SR
- L. Mindoš, H.Geiplova, Study Of Effect Of High Boiled Non-Building Compounds' Depletion From Epoxy Coatings To Its Corrosion Protection, EUROCORR 2009, 6-10.8.2009, Nice, France
- L. Mindoš, The verification of high-boiling voc migration from epoxide coating layer onto its protective properties, Sborník 40th International Conference On Coatings Technology, May 18-20, 2009, ISBN 978-80-7395-176-4
- L. Mindoš, Urychlené korozní zkoušky s akcelerovanou ztrátou VOC z vrstvy organických povlaků, Sborník 6. Mezinárodní odborný seminář progresivní a netradiční technologie povrchových úprav, 24. - 25. 11. 2009, Brno, ISBN 978-80-904502-0-2

In 2009 the book ***The Effects of Air Pollution on Cultural Heritage*** (ISBN: 978-0-387-84892-1) had been published by Springer Science&Business Media, J. Watt et al. (eds.). SVUOM's specialists participated on Chapter 6: Watt J., Doytchinov S., Lefevre, R.A., Ionescu A., Fuente de la D., Kreislova K., Screpanti A.: ***Stock at Risk***.

This book examines the impact of air pollution on cultural heritage materials because it can lead to loss of important parts of our history and culture. Studies investigating the relationships between pollution concentration (dose) and the resulting damage (response) are described and the latest research findings for dose-response functions presented. Trends in pollutant emissions, ambient concentrations and changes in building

damage over time are discussed and future predictions presented.

The book summarises results of international research projects UN/ECE ICP Effect on Materials, MULTI-ASSESS and CULT-STRAT in which SVUOM specialists participated.



In 2009 SVUOM Ltd. published special guidelines for industrial praxes:

- **Corrosion map of ČR for carbon steel - special map** (ISBN 978-80-903933-4-9),
- **Corrosion map of ČR for zinc - special map** (ISBN 978-80-903933-3-2).



Licences

Applied methodology

V.Číhal, M.Kadlecová, *Evaluation of corrosion resistance on stainless materials in various concentration of solution, vapours and condensate*

The developed methodology of evaluation allows to determinate in one step the corrosion resistance of stainless steel for basic concentration of nitric acid in solution, vapour and condensate too. Together with this methodology the testing equipment was designed and assembled.



E.Kalabisová, L.Turek, V.Vodička, *Testing method for measurement of instantaneous corrosion rate of steel reinforcement embedded in concrete*, Annex C to TP 175 (Technical requirements of MD)

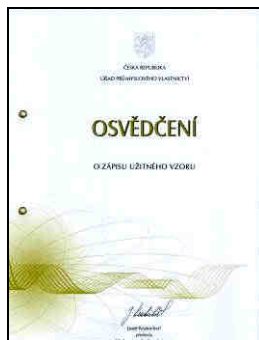
Measurement is taken from the surface of the concrete, rather than by using a reference half-cell embedded adjacent to the reinforcing bar, the measurement may need compensating for a contribution from the concrete resistance between the concrete surface and the surface of the bar. Key parameters are concrete mixture, chloride content, humidity, temperature.



The protection of industrial designs by its registration in the register is intended for the design solutions. The product means an industrially or hand-made three-dimensional or two-dimensional object. In the Czech Republic a central body of state administration is Industrial Property Office which performs a function of a patent and trademark office.

In 2009 the SVUOM's results of R&D project had been registered:

- an **industrial design No 20508** (G 01 N 1/28) of special magnetic holder for samples exposed at accelerated corrosion tests,
- an **industrial design No 20664** (G 01 N 17/02) of the equipment for non-built vapour organic compounds diffusion acceleration from organic coating layers mainly for acceleration of corrosion tests



Structure of company

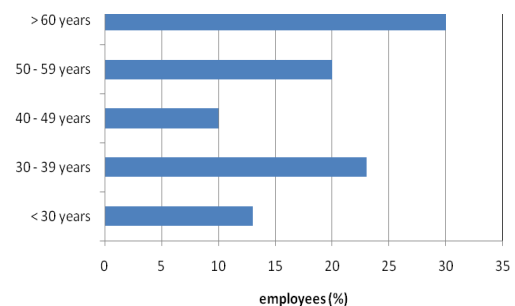
The commercial and research activities are solved in special divisions of company:

- division of atmospheric corrosion,
- division of corrosion engineering,
- division of organic coating,
- division of inspection,
- certificated laboratories.



Employees and competence

The most important asset of a knowledge-based institute like SVÚOM is its intellectual capital. In 2009 the SVÚOM had a total of 30 employees from which 24 have university degree including 1 professor and 3 doctors. There is even distribution of the sexes (57 % of employees are women).



SVUOM's specialists are members of international and national TC of standardization organizations (ISO, CEN) and active participate on elaboration of technical standards in the field of corrosion and corrosion protection specification and testing.

SVUOM's specialists are certificated as corrosion engineers and corrosion technologists according to Std- 401 APC.

SVUOM specialists are nominated by Ministry of Industry and Ministry of Environment as members of EU TWG for preparation BREF documents in categories 2.6 *Installations for the surface treatment of metals and plastics using an electrolytic or chemical process where the volume of the treatment vats exceeds 30 m³* and 6.7 *Installations for the surface treatment of substances, objects or products using organic solvents with a consumption capacity of more than 150 kg per hour or more than 200 tonnes per year.*

Economy

Survey of economy (in thousands of CZK)

Balance sheet	2006	2007	2008	2009
financial assets	10 857	16 857	16 790	16 826
tangible fixed assets	7 486	7 355	6 787	6 174
debtors due within one year	1 422	2 167	3 083	2 328
cash at bank	528	7 282	6 887	8 254
subscribed capital	6 568	9 044	400	0
revenue from R&D per research worker	502	741	835	668

During whole year 2009 the downturn of Czech economy affected SVÚOM's customers and the number of testing and inspection cases from industry decreased. It had a significant effect on SVUOM profit.

Long-term economy tendency

Thousand CZK

The SVUOM Ltd. does not distribute its profits, i.e. the financial results arising from the company business shall be re-invested in the company concerned. In 2009 the some new instruments and equipments had been purchased to improve the quality of corrosion and protective coatings measurement, e.g. coating thickness measuring gauge, ultrasonic measuring gauge, polishing machine for metallographic specimen preparation, etc.

