MANIFESTO OF THE CARBON CENTURY

2010:

Why does humanity have only a quarter of a century to change its materials usage?

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carbon nanomaterials for the global industry

01

TECHNOLOGY'S EARLY HISTORY

About 13 000 years ago humankind moved from collection to production. The Neolithic Revolution helped our species preserve itself, compete and survive in the wild.

250 years ago, the Industrial Revolution happened.
Switching to machine production allowed people to increase productivity by several times, going beyond limit of what humankind could create by hand. Civilization launched the snowballing process of growth of production.

02

CIVILIZATION IS TRANSFORMED

Only a few decades changed the face of civilization beyond recognition. Fundamental problems, which humanity had faced for thousands of years, were now solved in a short period of time. The scientific and technological revolution began quite recently, only in the second half of the twentieth century. During this short period, by the standards of history, scientific and technological discoveries and inventions numbered in millions.

Victories over infant mortality and infectious diseases doubled life expectancy (38 years in 1900 England – 81 years in 2011).

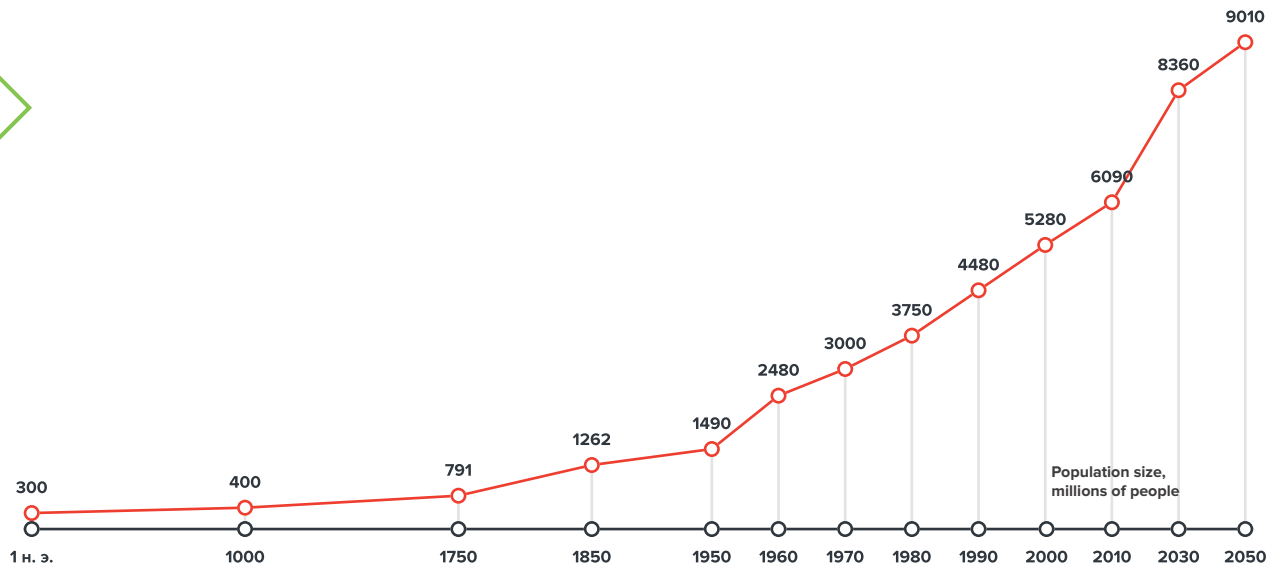
The problem of hunger and food shortages (350 000 people died in Ireland in 1845-1849 due to potato crop failure) was solved by the use of fertilizers and pesticides, by breeding high-yielding varieties of plants and species.

The development of modern transportation made freight more accessible and travel became a mass phenomenon. The world was physically united.

Finally, the digital revolution solved the problems of communication. Exchange of information has become universal and instantaneous. The world had finally become global and unified.

All this happened within a very short timespan of rapid change.

03



POPULATION GROWTH ACCELERATES

The achievements of the post-industrial revolution improved living conditions, resulting in an accelerated growth rate of the world's population, fueling an equally drastic race in the quantity of materials to service them.

The projected increase in population size from 2011 to 2015 is over 1.0 billion new people.

04

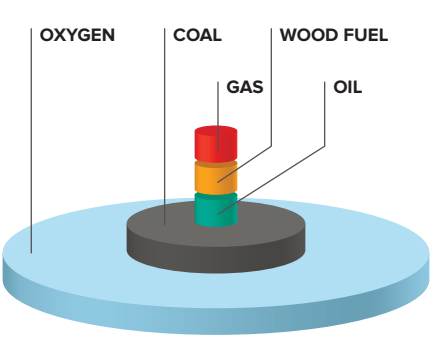
INCREASING PRODUCTION AND ENERGY GROWTH

This rapid increase in population size and the demand from people to improve their lives through a variety of products has brought with it a dramatic increase in the production of basic materials.

1980 — **3 000 000 000** tons of materials

2000 — **7 500 000 000** tons of materials

WE TAKE FROM THE BIOSPHERE



20 billion tons **of oxygen**

8 billion tons **of coal**

1 billion tons **of wood fuel**

1 billion tons **of gas**

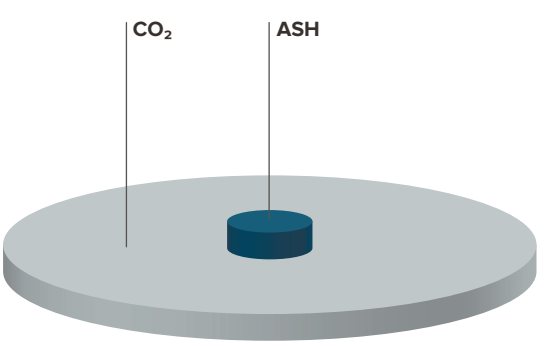
1 billion tons **of oil**

Over the past 15 years the production of materials has doubled. Within the next 25 years, by conservative forecasts, the production of materials will double again. By 2040, the world will produce 30 billion tons of materials annually.

04

In addition to the increased production of materials, humanity also has ever-increasing demands for Energy, accompanied by unintended side effects such as CO2 production and releasing ash into the Biosphere.

WE EMIT INTO THE BIOSPHERE



28 billion tons **CO_2**

3 billion tons **of ash**

4 tons **CO_2** 400 kg **ASH** per capita annually

2020 **15 000 000 000** tons of materials

2040 **30 000 000 000** tons of materials

05

THE FUNDAMENTAL CONFLICT

Demand for materials
Demand for energy

VS

Biosphere destruction
Energy deficit

For the first time in history, human civilization has come to an inner conflict between our resource usage and the biosphere. The fundamental demand for materials and energy has given rise to major threats — the irreversible destruction of the biosphere and planet-wide climate change.

Used at the current rate, the planet's resources are not sufficient to ensure all the Earth's inhabitants can have the benefits of modern civilization.

In the next 30 years, is it possible to provide 9 billion people with housing, transportation, communication and other benefits of modern civilization while reducing the production of materials and energy... by two times?

YES

This requires improving the weight-related properties of all basic materials by four times (e.g. strength / weight, conductivity / weight), in turn reducing the quantity of materials needed to accomplish the same task.

06

THE SOLUTION: SUPER-COMPOSITES

It is impossible to create a new infrastructure for the production of billions of tons of material quickly — there is no time and there are not enough resources available, not to mention political will, knowledge, and money to switch to production of new materials for every industry. That is why the infrastructure of any new materials production should use all the facilities already available to mankind.

Is it possible to create such a technology?
Yes, by synthesis of super-composites.

?

Composite

a material made of at least two components with significantly different properties, creating a material with new characteristics when combined

REINFORCED CONCRETE

Concrete + steel reinforcement

RUBBER MATERIALS

Rubber substance + carbon black

FIBERGLASS

Glass fiber + epoxy

CFRP

Carbon fiber + epoxy

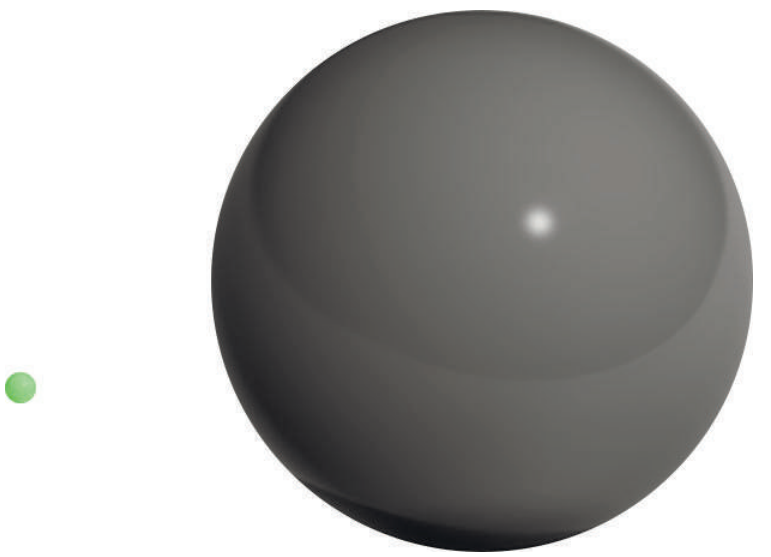
If the components match perfectly, the properties of the end product are the average of the properties of its components in proportion to their mass fraction.

06

ONE PERCENT OF ONE MATERIAL MAY INCREASE THE STRENGTH OF OTHER BY 4 TIMES

If to want to enhance the original material by 4 times, via a hardening additive of just 1%, the strength of this additive should be 400 times stronger than the original material.

Conceptually, this approach fits for all properties – strength, durability, electrical conductivity, etc.



07

THE UNIVERSAL ADDITIVE: REQUIREMENTS

The requirements for such a supermaterial, that can be added as 1% or less to other materials and change the composite to have highly improved properties, are extremely difficult to obtain. Of all the substances known by humankind, only carbon nanotubes and the recently discovered graphene may serve as such an additive.

Supermaterial

- Extreme strength
- Record electrical and thermal conductivity
- Chemical inertness
- Ability to form a chemical compounds with a huge range of substances
- Very low specific weight
- A huge surface area
- Thermal stability

Scalable technology

- Non-toxic components
- Non-toxic wastes
- Economically and physically available raw materials
- Scalable technology
- Minimum energy consumption
- Safe technological process

08

SINGLE WALL CARBON NANOTUBES

On October 5, 2010, the Nobel Prize was awarded for the discovery of graphene, an incredible substance with very unique properties. But over the past 20 years another form of graphene has also been highly researched, called a single wall carbon nanotube. Single wall nanotubes (SWCNT) are sheets of graphene rolled into cylinders, enabling a different set of equally incredible properties. Tens of thousands of experiments have been conducted, and over the past ten years more than 10 000 patents have been registered.

Thousands of scientific publications have confirmed that nanotubes are:

- 100 times stronger than steel
- One of the best conductors in the world
- The record length to diameter ratio (1 000 000 times)
- Large surface area (the surface area of 1 gram of SWCNT equals 2 basketball courts)
- Thermally stable (more than 1000 °C)

A huge amount of R&D has already confirmed a crucial fact for our civilization: single wall carbon nanotubes are a truly universal additive, with the ability to greatly improve the properties, from durability to electrical conductivity, of an incredibly wide range of materials. In turn, a lower overall quantity of base materials is necessary, reducing the impact on the biosphere and humanity's role in climate change.

08

WHY IS A SUPERMATERIAL LIKE CARBON NANOTUBES LEFT UNUSED BY CIVILIZATION?

High price

$100 000 per 1 kilo of single wall carbon nanotubes — is beyond economic viability (aluminum $2/kilo), even at 1% loadings.

Unscalable technology

The global production of 1 ton per year is far too limited to have an impact on consumer-scale production and industrial applications.

Everything will soon change.

Carbon nanotubes will become a new composite base material, produced industrially at minimal costs and in mass-production volumes. They will change most materials in the world.

Civilization can overcome its challenges.
The world of materials will change beyond recognition.
Welcome to the age of carbon.

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POST SCRIPTUM

OCSiAl calls out to all investors, researchers, scientists, inventors, businesspersons, innovators and manufacturers to join efforts in solving the materials and energy gap. We invite global industry to create materials using the unique properties of nanotubes.

We urge you all to realize the importance of this moment and invest all effort in hastening the start of a new era, the Carbon Era of Civilization. The era in which carbon, being the cornerstone of life and the biosphere, will no longer be a threat and become the saving element of new material production. The era when all materials on the planet have properties which haven't been seen before.

Welcome to the carbon revolution.
OCSiAl, since 2010.