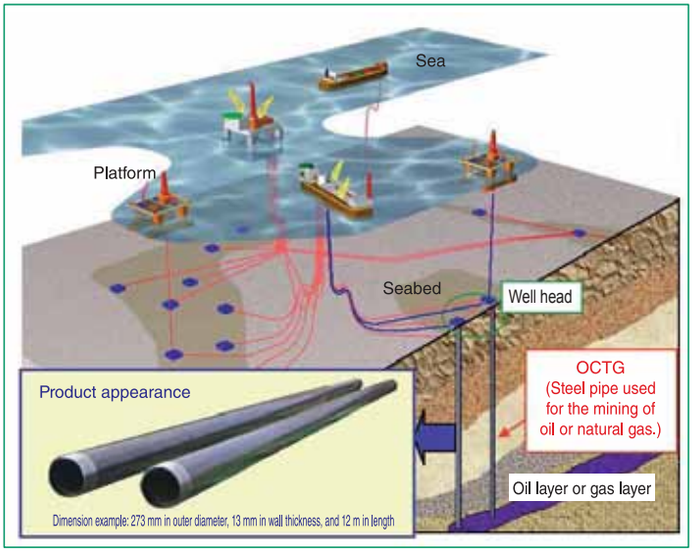
Sumitomo Metal Industries newly developed a steel pipe with super-high strength and corrosion resistance, thus contributing to an increase in the production of natural gas with the generation of CO_2 suppressed (a product that won the National Invention Grand-prix Prize).

Super-high Strength, Sour-resistant, Low Alloy Steel Oil Country Tubular Goods (OCTG)

Features

- An unprecedented super-high strength low alloy steel oil country tubular goods (OCTG) providing improved sour resistance (sulfide stress cracking resistance).
- Contributes to an increase in the production of natural gas exploited from a high-depth stratum where corrosive gas (hydrogen sulfide) exists.
- Increases the production of natural gas with the quantity of CO_2 generation reduced to 3/4, thus reducing the generation of approximately 8 million tons of CO_2 annually in comparison with oil with the same energy.※



General View and Operation of Oil Well Tubular

Overview (Technical principles, actions, etc.)

Alloying elements, such as Al and Ca are added to steel to stabilize and eliminate impurities such as oxygen and sulfur while Ti and Nb are added for crystal grain refinement during steel making and refining. Therefore, non-metallic inclusions, such as oxide, sulfide, and carbonitride particles are inevitably produced. If conventional steel shown in **Fig. 1** is exposed to a sour environment, the coarse inclusions on the steel surface will become the origin of corrosion (pitting), thus causing sulfide stress cracking (SSC). The size and volume reduction of the inclusions in the steel as much as possible is effective for the prevention of SSC, which, however, is not attained satisfactorily by conventional technology. The prevention of SSC on high-strength steel had been considered unsolvable problem.

As shown in the electron micrograph in **Fig. 1**, the technology introduced here generates complex inclusions, i.e., Al-Ca oxysulfide inclusions in the center and Ti-Nb carbonitride inclusions around the oxysulfide inclusions, thus suppressing the growth of nonmetallic inclusions while miniaturizing and dispersing the nonmetallic inclusions.

Based on this technology, an ultrahigh-strength sour oil well tubular with an SSC resistance of the 125-ksi grade (862 MPa) was developed with a remarkable improvement in the SSC resistance of high-strength steel.

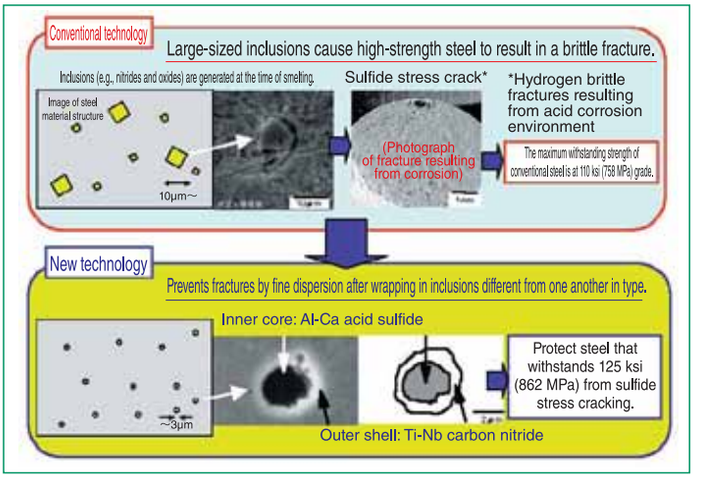


Fig. 1 Features of New Oil Well Tubular Technology

Introductory Track Record

- **The invention was used to develop 125 ksi (862 MPa) grade sour resistant OCTG in 2003, the first material of that kind in the world, which underwent qualification testing through the collaborated researches with major oil companies, BP p.l.c in UK and Statoil in Norway.**
- **The newly developed high strength OCTG was applied in fields in the UK, Norwegian North Sea, and Caspian Sea, which enabled the exploitation of deep natural gas sour wells (4000 - 6000 meters depth).**

Effects

It is concluded that the invention contributes to the development of natural gas worldwide supply, resulting in a decrease in CO_2 emission and the prevention of the greenhouse effect. Exploitations of deep and corrosive gas wells are increasing in the world, requiring the newly developed 125ksi (862MPa) sour grade OCTG.

[Quantity of production with this product and CO_2 reduction]

- The figure for 4 natural gas development projects undertaken by BP and Statoil.
  3.1 billion Nm3/year x 4 projects = 12.4 billion Nm3/year
- ※The CO2 reduction achieved by the natural gas projects above (the CO2 reduction assuming that all the oil fuels are switched to natural gas fuels, and calculated as the difference of CO2 generated by oil and natural gas when burnt to obtain the same amount of thermal energy): 8 million tons/year

Applicable field
Steel pipes for oil wells (seamless steel pipes for natural gas mining), high-pressure hydrogen gas containers (for fuel cell applications such as electric vehicles)

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