The Titanic tragedy: Steel then and now

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By Wayne Geyer, STI-SPFA

One of the most well-known maritime stories is the sinking of the Titanic. Dozens of movies have been produced about it, notably the 1997 blockbuster produced by James Cameron.

The Titanic was lauded as the biggest and finest luxury passenger vessel in the world. It was labeled "unsinkable," but we all know the end of the story: the Titanic sunk on its maiden voyage in 1912.

Construction of the Titanic was an engineering feat in itself, beginning March 31, 1909. It was 882 feet long and 92 feet wide, and took three years to complete. The ship featured electric lights, tennis courts, elevators, heaters, and even a swimming area.

The Titanic was designed with safety as a priority. It featured a steel hull and 16 compartments, supposedly capable of being sealed off from one another.

But on its maiden voyage, the Titanic struck an iceberg that fateful evening in 1912. Initially, only five compartments were damaged and flooded, but water quickly flooded into two more compartments and the tragedy was set in motion. The Titanic sank in less than three hours after the impact. Fifteen hundred passengers and crew died.

Steel quality 113 years ago

The wreckage of the Titanic was discovered in 1985, enabling researchers and historians to determine why the unsinkable ship did not even complete a single voyage. One of their findings was that the steel used in the hulls cracked.

In 1997, a metallurgical engineering professor at the University of Missouri-Rolla performed tests on the steel and found it was not as impact-resistant as modern steel. Tests found the Titanic's steel to be ten times more brittle at the freezing temperature of water. Yet it was probably the best steel available at the time.

Tests of the steel chemistry also showed high content of sulfur, oxygen and phosphorus, and a low level of manganese – all in ratios of those elements that can contribute to a reduction in steel ductility. That is known today, but was not as well known in 1909, nor could the manufacturing processes of the time control the chemistry as precisely as today's mills.

What else went wrong?

There were many other factors that contributed to the Titanic tragedy – design of the ship, negligence of the crew, a lack of lifeboats, etc., but another research study indicates that the faulty rivets were a significant cause.

Poor quality materials were accepted in order to complete the construction on time. Low-quality slag material was used in rivets, a material that does not hold its integrity in cold environments such as freezing water. Three million rivets had to be heated to the right temperature and pounded to hold the steel hull together in a specific manner to seal the joints. Records indicate that the project also lacked sufficient skilled riveters.

Only in the central hull of the ship were rivets made of steel. Some researchers claim that if the proper rivet material had been used and installed throughout the ship, it would have floated longer, allowing more rescue operations.

There are many hypotheses about the cause of the sinking

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of the Titanic. The story has captivated scientists for over 100 years. This research attributes the tragedy to the use of unskilled labor and low quality metal rivets.

Steel quality today

Today's steel is of remarkably high quality. Proportions of the elements used to create steel are precise and can be modified to form hundreds of different metal formulations.

Steel-making processes are vastly superior to 100 years ago. When you visit a new steel mill, you'll find an automated process using computers to control and monitor production, and you'll see fewer people on the floor. Many of today's mills also use recycled steel as their raw material.

And innovations continue. By 2025, the federal government will require auto manufacturers to meet a fuel efficiency standard of 54.4 mpg. Automakers must make light weight vehicles without sacrificing safety. Hence, the steel must be lighter weight, but stronger and still formable.

The steel industry is developing new high strength steel to help auto makers meet these requirements. The Missouri University of Science and Technology (yes, Mizoo did the Titanic research, too) is developing a third generation high strength steel.

The strength of steel

Engineers and buyers seek certain properties for their projects, and other materials attempt to compete with steel. For STI's members who fabricate underground fuel storage tanks, it's steel versus fiberglass reinforced plastic. For their large water reservoir tanks, it's steel versus concrete. For building construction, it's steel versus concrete versus wood.

Ford recently introduced a revamp of its F150 pick-up truck, using aluminum instead of steel. Chevrolet has responded with ads comparing its high strength steel Silverado truck to Ford's F150 aluminum truck. For example, here's a consumer audience's take on a new superhero, "Aluminum Man": https://youtu.be/_HnCKV8cwSs. Clearly, these folks know the strength of steel is an important property that makes it superior to other materials.

100 years of steel fabrication

STI-SPFA is celebrating its 100th Anniversary in 2016. See our anniversary webpage for interesting photos and history of the steel fabrication industry: http://www.steeltank.com/.

For a century, our member manufacturers have fabricated the best in steel fuel and water storage tanks, pressure vessels and water pipe. We're proud to fabricate with steel, building products that are strong, safe, long-lasting, cost-effective, and that contribute to the nation's infrastructure.

Appreciation is expressed to the following websites and publications for information included in this article:

- http://www.sciencedaily.com/releases/1997/12/971227000141.htm
- http://www.historyofthetitanic.org/history-of-the-titanic.html
- http://www.titanicuniverse.com/weak-rivets-might-have-caused-the-titanic-to-sink/1108