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New Materials Technology Will Help Exploration Reach Extreme Frontiers

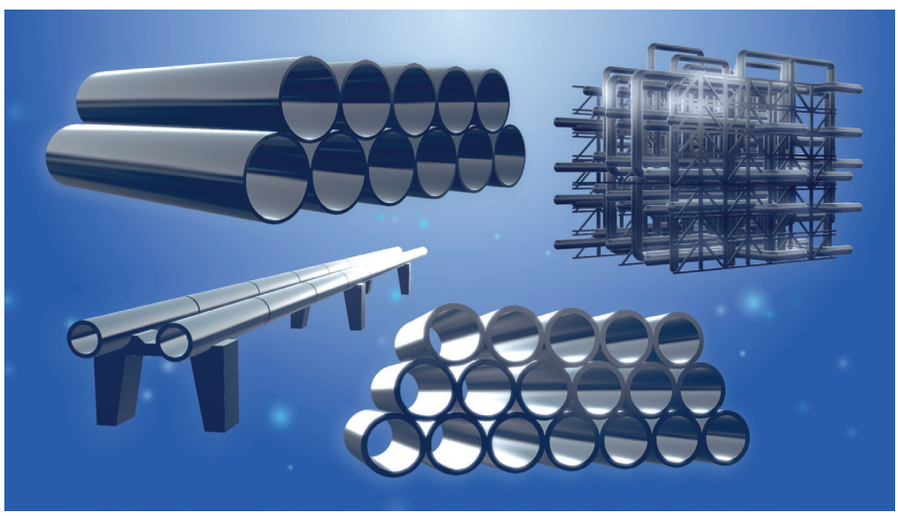
Material selection is widely regarded as the first line of defence against the critical failure of a product application in the oil and gas industry.

The key considerations for alloy selection typically include the application of the material, required properties, industry regulations and of course, the 'short term versus long term' cost. After scrutinising the materials with the aforementioned criteria and correctly specifying one, the chosen grade should last for its anticipated lifespan with minimum maintenance.

This is the ideal, but where a material is applied improperly – perhaps one that is not necessarily the best fit for a particular environment – problems can occur. This can result in unwanted costs and delays to projects, with even severe health, safety and environmental consequences. So the material selection and specification processes are vitally important steps.

With exploration expanding into more deeper and challenging conditions in regions such as the North Sea, the Gulf of Mexico and the pre-salt fields in Brazil, the demand for advanced solutions in global onshore and offshore markets is expected to increase dramatically over the coming years and decades, particularly for corrosion resistant alloy (CRA) pipeline materials.

Service conditions including elevated temperatures, high pressures, high mechanical loads and aggressive process media pose very different challenges for existing CRA pipeline materials and at present, there isn't one that can satisfy all design requirements. It's a dilemma for industry specialists because whatever available material they choose, there often has to be a compromise and therefore the associated risk that comes with it. But with the development of the N'GENIUS Series, a change is on the horizon.



Above: N'GENIUS can be utilised for seamless and welded line pipe, onshore pipelines and modules.

A Series without limits

The N'GENIUS Series of high strength austenitic stainless steels represents the total reinvention of conventional austenitic stainless steels – more commonly known as the 300 Series. N'GENIUS possesses all the associated benefits of austenitic stainless steels including ductility and toughness at sub-zero and cryogenic temperatures but with unprecedented advantages – vastly superior corrosion resistance and exceptional strength properties that are comparable to those of duplex and super-duplex stainless steels.

Its unique combination of engineering design characteristics allows product forms and ancillary equipment to be developed with reduced wall thicknesses and overall size, making products lighter and with less material. Not only will these products then be easier to handle and transport to site, it also means the project would benefit from weight savings, a reduction in construction and project costs and produce lower carbon emissions. Meanwhile, the corrosion resistance of N'GENIUS will also increase the lifespan of these projects and help to reduce maintenance costs.

With an extensive range of alloy types, variants and grades, N'GENIUS can be specified by end user clients or their nominated engineering companies and utilised for an infinite range of project applications in the oil and gas industry, including CRA pipelines.

N'GENIUS CRA line pipe can be installed via J-lay, S-lay, Reel-lay and subsea Bundle installation techniques.

The N'GENIUS solution for pipelines

The N'GENIUS Series of CRA line pipe grades, which can be manufactured in both seamless and welded product forms, offers a virtually unlimited choice of high strength austenitic stainless steels that are stronger, last longer and are more environmentally sustainable. What's more, as these grades possess a much lower nickel content compared to many high-performance stainless steels and nickel alloys, it's a cost-effective choice compared to the many higher alloyed materials already being specified.

This revolutionary pipeline technology has been created to outperform existing grades in the API 5LC specification for CRA line pipe and the DNV ST-F101 Offshore standard for

Pumps, valves, flanges, rings and other products can be made in the N'GENIUS Series.

sub-marine pipelines, whilst also addressing the need for a much wider selection of materials for projects.

The various challenges presented by high pressure, high temperature projects and process media environments that contain chlorides, CO2, H2S and other constituents has forced engineers and specialists to compromise on material selection. However, N'GENIUS will address this issue with a greater variety of CRA line pipe materials that are suitable in a wide range of service conditions and harsh environments, in all types of onshore and offshore projects in shallow, deep and ultra-deep water.

Furthermore, the superior engineering design characteristics of N'GENIUS – including high mechanical strength and excellent ductility and toughness – will allow for these pipelines to be installed by many of the most common methods of subsea installation including S-lay, J-lay, Reel-lay and subsea bundle techniques.

But in terms of product forms, there is no limit to the capability of N'GENIUS for oil and gas industry.

A material for your entire system

As well as being ideally suited for line pipe, N'GENIUS can be manufactured and supplied in a vast array of wrought and cast products for both onshore and offshore oil and gas production, making it the total system material.

Among the various products and equipment that can be manufactured using N'GENIUS are pumps, valves, fittings, flanges, manifolds, rigid risers, catenary risers, flowlines and many more.

For a more extensive list please visit

www.ngeniusmaterials.com.

Meanwhile, for design engineers with a primary concern for the long and safe operation of oil, gas and condensate wells, the availability of durable, pressure and corrosion resistant downhole casing and tubing is imperative and N'GENIUS can provide the perfect answer for the increasing demand in CRA Oil Country Tubular Goods (OCTG).

N'GENIUS also ensures outstanding resistance to hydrogen embrittlement and stress corrosion cracking in aggressive environments which can present a serious problem for many current pipeline and OCTG materials.

N'GENIUS support for end users

To assist end user clients and their various engineering consultants, companies and contractors with the material selection and specification process, a vast range of material data sheets are available for various product types that specify the minimum criteria for the manufacture, inspection, testing and control of products developed using the N'GENIUS Series. These have been created in accordance with international codes, standards and specifications for each alloy type, variant and grade in the N'GENIUS Series.

For oil and gas industry projects globally, whether upstream, midstream or downstream, the materials selection philosophy is about to fundamentally change in a truly N'GENIUS way.

The N'GENIUS Series is patent protected in 30 countries around the world and is available to be manufactured under licence by premier manufacturers of stainless steel products. Engineers interested in finding out more about N'GENIUS can visit:

www.ngeniusmaterials.com

N'GENIUS ICONIC LM4N SERIES™ LINE PIPE - ALLOY TYPES & GRADES			MECHANICAL PROPERTY REQUIREMENTS					
Line Pipe Alloy Types High Strength Austenitic (HSA)	Line Pipe Grade Designations (API 5LC)	Line Pipe Grade Designations (DNV-ST-F101)	Yield Strength (YS) Min		Tensile Strength (TS) Min		[A] Elongation Min in 2 inches (50.8mm)	[B] PRE_N
			Ksi	MPa	Ksi	MPa	%	
N'GENIUS ICONIC 21Cr-HSA™	LC55-21172 LM4N	DNV-380-21172 LM4N	55	380	109	750	30	≥35.0
N'GENIUS ICONIC 21Cr-HSA™	LC62-21172 LM4N	DNV-415-21172 LM4N	60	415	109	750	30	≥37.0
N'GENIUS ICONIC 21Cr-HSA™	LC65-21172 LM4N	DNV-430-21172 LM4N	62	430	109	750	30	≥39.0
N'GENIUS ICONIC 21Cr-HSA™	LC60-21174 LM4N	DNV-415-21174 LM4N	60	415	109	750	30	≥41.0
N'GENIUS ICONIC 21Cr-HSA™	LC62-21174 LM4N	DNV-430-21174 LM4N	62	430	109	750	30	≥43.0
N'GENIUS ICONIC 21Cr-HSA™	LC65-21174 LM4N	DNV-450-21174 LM4N	65	450	109	750	30	≥45.0
N'GENIUS ICONIC 21Cr-HSA™	LC60-21176 LM4N	DNV-415-21176 LM4N	60	415	109	750	30	≥46.0
N'GENIUS ICONIC 21Cr-HSA™	LC62-21176 LM4N	DNV-430-21176 LM4N	62	430	109	750	30	≥47.0
N'GENIUS ICONIC 21Cr-HSA™	LC65-21176 LM4N	DNV-450-21176 LM4N	65	450	109	750	30	≥49.0
N'GENIUS ICONIC 23Cr-HSA™	LC62-23192 LM4N	DNV-430-23192 LM4N	62	430	109	750	30	≥38.0
N'GENIUS ICONIC 23Cr-HSA™	LC62-23192 LM4N	DNV-430-23192 LM4N	62	430	109	750	30	≥40.0
N'GENIUS ICONIC 23Cr-HSA™	LC65-23192 LM4N	DNV-450-23192 LM4N	65	450	109	750	30	≥42.0
N'GENIUS ICONIC 23Cr-HSA™	LC62-23194 LM4N	DNV-430-23194 LM4N	62	430	109	750	30	≥42.0
N'GENIUS ICONIC 23Cr-HSA™	LC62-23194 LM4N	DNV-430-23194 LM4N	62	430	109	750	30	≥45.0
N'GENIUS ICONIC 23Cr-HSA™	LC65-23194 LM4N	DNV-450-23194 LM4N	65	450	109	750	30	≥47.0
N'GENIUS ICONIC 23Cr-HSA™	LC62-23196 LM4N	DNV-430-23196 LM4N	62	430	109	750	30	≥48.0
N'GENIUS ICONIC 23Cr-HSA™	LC62-23196 LM4N	DNV-430-23196 LM4N	62	430	109	750	30	≥50.0
N'GENIUS ICONIC 23Cr-HSA™	LC65-23196 LM4N	DNV-450-23196 LM4N	65	450	109	750	30	≥52.0
N'GENIUS ICONIC 25Cr-HSA™	LC62-25214 LM4N	DNV-430-25214 LM4N	62	430	109	750	30	≥45.0
N'GENIUS ICONIC 25Cr-HSA™	LC65-25214 LM4N	DNV-450-25214 LM4N	65	450	109	750	30	≥48.0
N'GENIUS ICONIC 25Cr-HSA™	LC65-25214 LM4N	DNV-450-25214 LM4N	65	450	109	750	30	≥50.0
N'GENIUS ICONIC 25Cr-HSA™	LC62-25216 LM4N	DNV-430-25216 LM4N	62	430	109	750	30	≥50.0
N'GENIUS ICONIC 25Cr-HSA™	LC65-25216 LM4N	DNV-450-25216 LM4N	65	450	109	750	30	≥53.0
N'GENIUS ICONIC 25Cr-HSA™	LC65-25216 LM4N	DNV-450-25216 LM4N	65	450	109	750	30	≥55.0

[A] The elongation tests shall be undertaken on full size specimens, where permissible, in accordance with the relevant specifications or standards.

[B] PITTING RESISTANCE EQUIVALENT MINIMUM: PRE_N = % Cr + (3.3 x % Mo) + (16 x % N)

Above: A selection of the many N'GENIUS CRA line pipe grades.