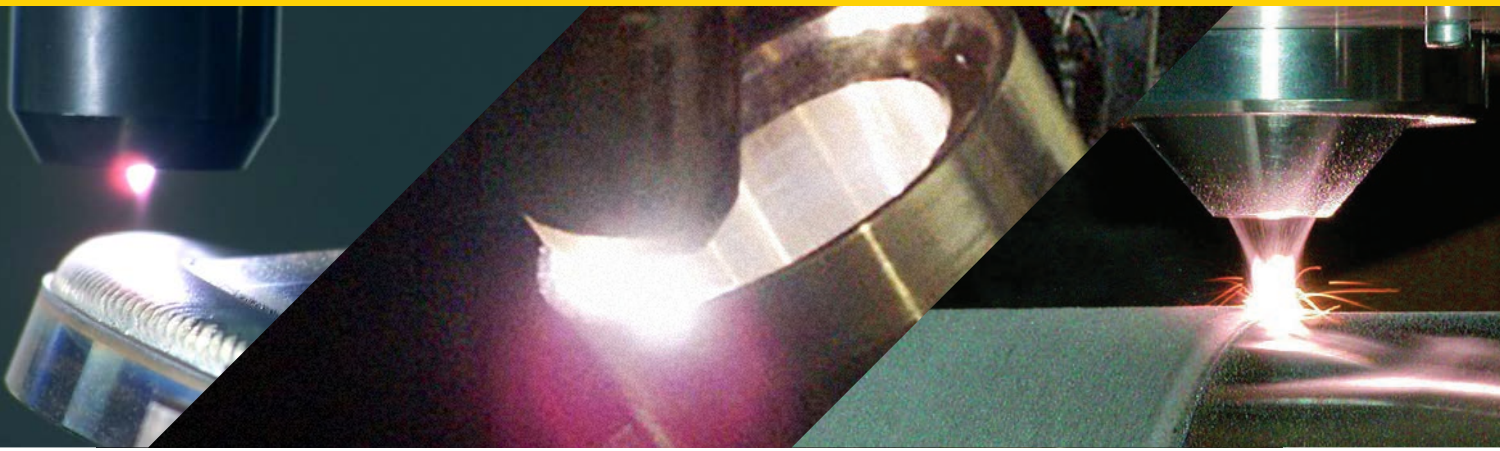


PTA

PROFESSIONAL SURFACING



Professional Surfacing

Kennametal Stellite is a global provider of solutions for wear, heat, and corrosion problems, and is a world-class manufacturer of Cobalt- and Nickel-based materials, coatings application equipment, and components.

Solid Cobalt- and Nickel-based alloy castings, coatings, and overlay materials provide protection for critical components in the operations of our customers in virtually all industries where high temperatures and wear are present. Our coatings application equipment may be added to your production facilities for added operational flexibility and control.

Industries Served

Kennametal Stellite offers its proven heat, wear, and corrosion experience and customized solutions to a broad range of industries, including:

- **Aerospace**
- **Oil & Gas**
- **Automotive**
- **Power Generation**
- **Steel**
- **Lumber**
- **Glass**
- **Other Process Industries**

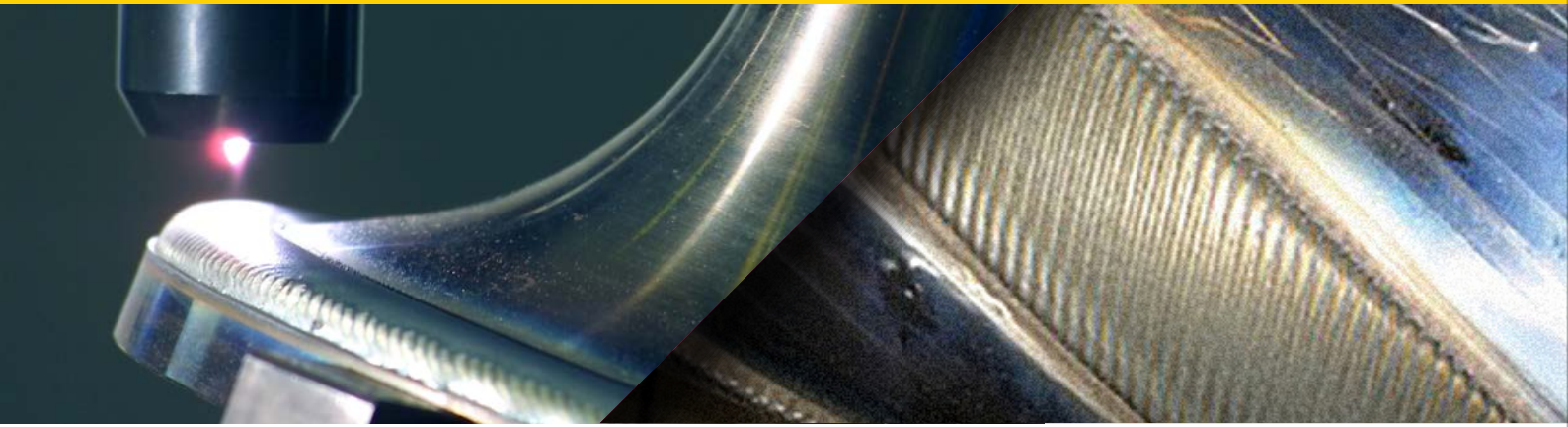


Kennametal Stellite Professional Surfacing

Kennametal Stellite brings you the most competitive professional surfacing solutions with state-of-the-art hardfacing equipment and high quality component surfacing services. Together, Kennametal and Kennametal Stellite offer the ultimate in component surfacing competence, providing customers with efficient and effective surfacing solutions. By adding value to our customers' components and process equipment, we support their increased performance, quality, and productivity.

We bring over 100 years of experience to bear on your difficult high heat, wear, and corrosion problems. We have direct experience in a broad range of industry segments, and we have the knowledgeable staff standing by who can help to reduce your problem-to-solution cycle. Kennametal Stellite coatings provide:

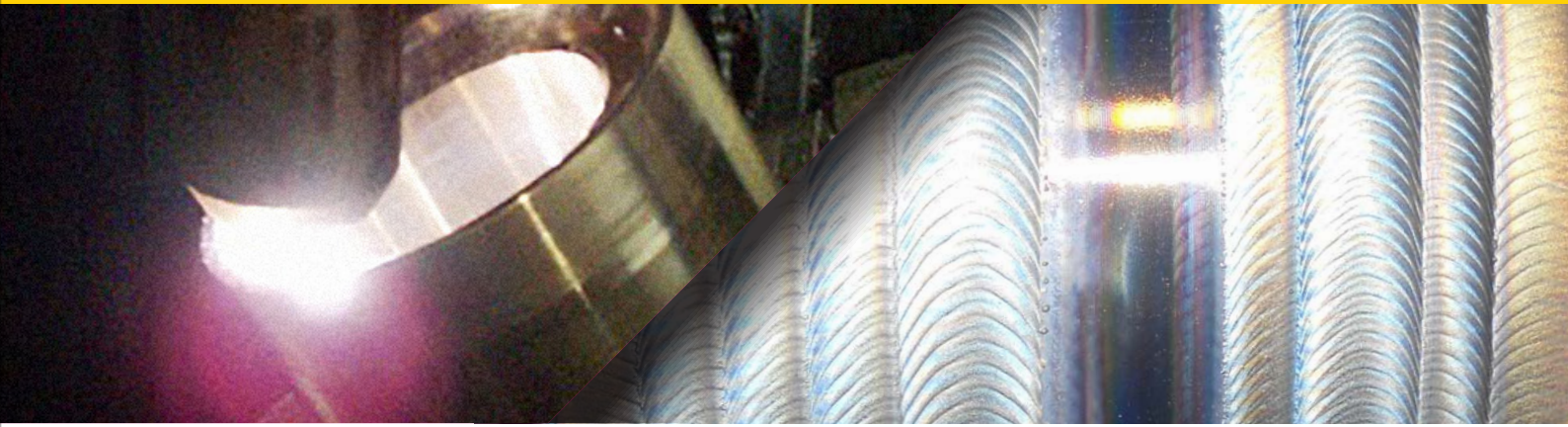
- **Extended component life.**
- **Reduced friction, wear, and corrosion.**
- **Increased production equipment productivity.**
- **Improved engine efficiency.**
- **Reduced service cost for power generation equipment.**



Partner for Productivity

For more than 100 years, we have worked with the leading companies in a variety of industrial segments. This has allowed us to improve our offering through continuous alloy and applications technology development.

From solution engineering to finish-machined coated component production, we are your partner of choice in selecting coating materials, coating and machining services, and coatings application equipment installed in your production facility.



Surfacing Equipment and Services Advantage

We have a vast array of materials and surfacing processes at our disposal. Once a solution is developed, we can provide you with our professional surfacing service, or we can assist you in adding surfacing technology to your manufacturing facility.

➤ ***Meeting your high quality standards AND your production schedule.***

When we become your surfacing service provider, we strive to meet your high quality standards and your production schedule by expanding our capacity and capability, as required.

➤ ***More than shipping you state-of-the-art equipment.***

When adding surfacing technology to your shop, we do more than ship you state-of-the-art equipment. We can assist with engineering knowledge and surfacing equipment production planning advice. In addition, we can make our in-house surfacing service available to you during your production ramp.



Fuel Efficiency ➤ *Automotive Engine Applications*

In most regions of the world, automotive emissions and fuel consumption legislation are tightening. Often, smaller engines with higher performance are called upon to meet these legislated changes.

Higher performance through increased fuel efficiency and extended engine lifetime.

Kennametal Stellite can help you achieve this excellent performance with smaller engines through improved component technology, and surface application of Stellite materials — which increase fuel efficiency and engine lifetime.

Surfacing services at your local Kennametal Stellite production facility are also offered, along with installation of PTA surfacing technology equipment right in your own production facility.



Valve Star PTA Surface Application Equipment

Valve Star PTA surface application equipment improves production cost with improved cycle times, and has increased valve seat quality and reliability. Proprietary alloys are available for superior valve seat performance.



Steam Flow Regulation Power Generation Applications

Power generating facilities that utilize steam to drive a turbine will benefit from Kennametal Stellite surface technology in flow control devices, such as steam control and stop valves, and pump components.

Whether steam is generated in a coal or bio-mass-fired boiler, in a combined cycle gas turbine plant, in a nuclear power plant, or in a geothermal plant, reliable and complete flow control is required. Steam conditions vary significantly from sub-critical to ultra-supercritical, from dry to wet, from clean to dirty, and from continuous operation to infrequent start and stop cycles.

Kennametal Stellite can be of assistance in all of these environments by reducing valve component cost through replacement of solid cast alloy components with less costly surface solutions, and by reducing wear in steam valves, therefore increasing planned maintenance cycles. Wear performance can also be improved by selecting or developing the most appropriate materials and applications technology.

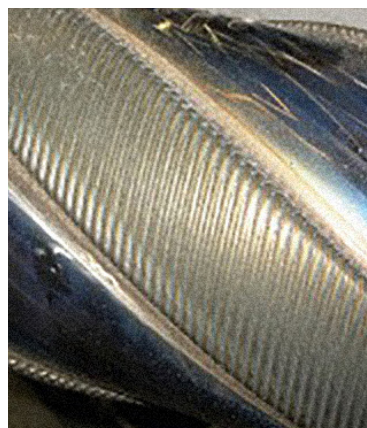


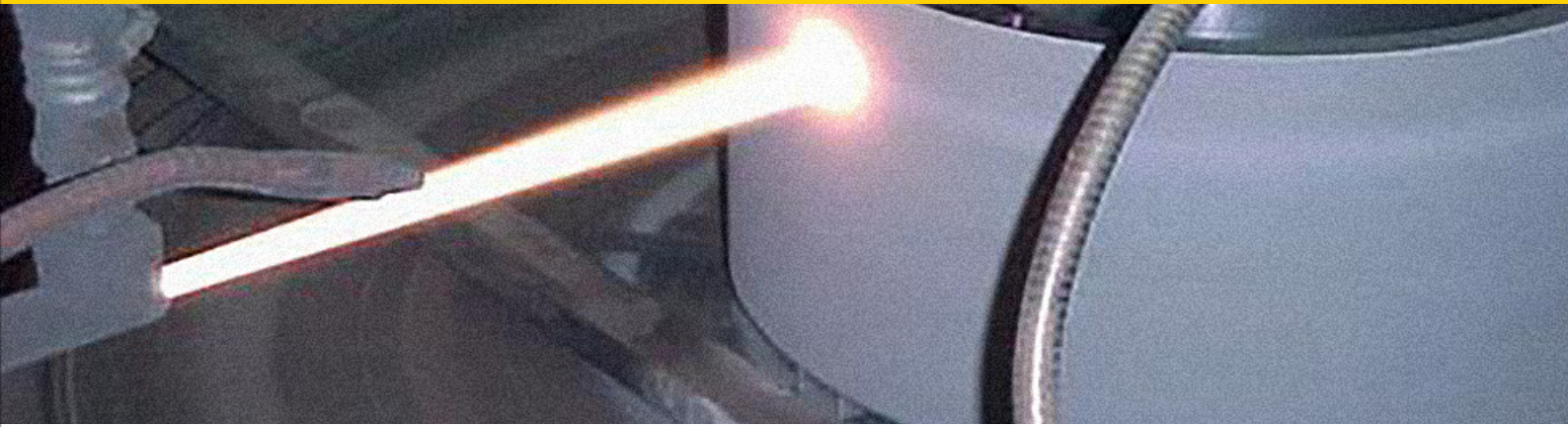


Wear Protection ➤ *Upstream Oil & Gas Applications*

Kennametal and Kennametal Stellite are involved in virtually all aspects of the upstream oil and gas industry. We provide a vast array of surface technologies and applications equipment through solid cast components, working with industry leaders to improve the performance and reliability of their:

- PDC and tri-cone drill bits.
- Fracking pump, manifold, and safety valves.
- MWD and LWD tools.
- Hardbanding and Stabilizers.
- Surface and SAGD Oil Sands extraction equipment.





Surface Technology ➤ Application Equipment

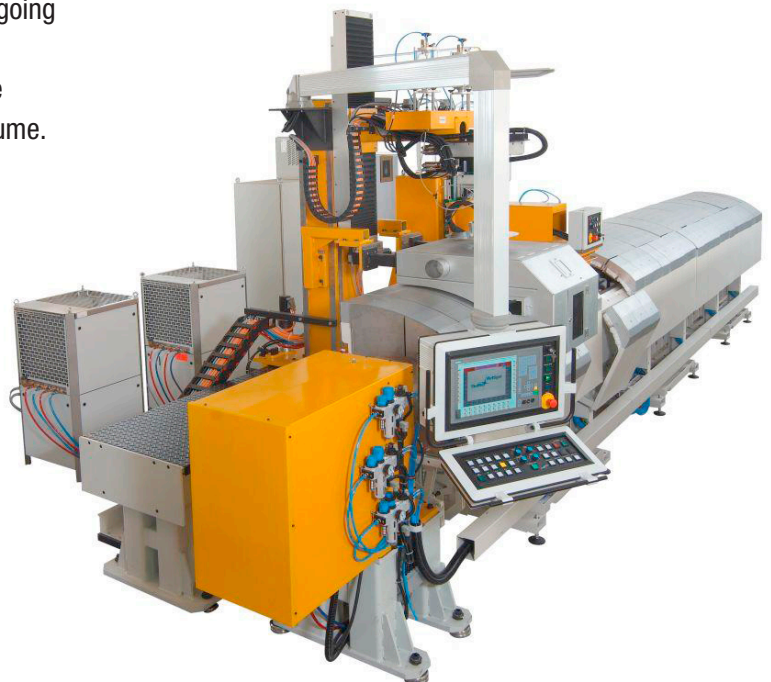
When you install Kennametal Stellite surface technology application equipment in your facility, you get more than just state-of-the-art equipment and materials. You maintain the applications knowledge for your application in-house, and gain production flexibility — allowing batch or one-piece flow to suit your operations. You also receive ongoing support for fixtures, materials selection/development, and component design changes, as well as assistance with first part trials and production stabilization at volume.

***Get more than just
state-of-the-art
equipment and materials.***



Kennametal Stellite™ HVOF Equipment

Kennametal Stellite's HVOF equipment portfolio is provided under the Jet Kote™ brand name. Ask us about our range of equipment packages.



Kennametal Stellite™ PTA Equipment

Kennametal Stellite's PTA equipment portfolio is provided under the Starweld™ brand name. The portfolio includes manual hand-held surfacing application through fully customized multi-axis/robot manipulation of the weld surface and application head.

■ **PTA Weld Deposition**

ALLOY	NOMINAL ANALYSIS OF POWDER¹								Others	UNS	Hardness (HRC)²
	Co	Cr	W	C	Ni	Mo	Fe	Si			
COBALT-BASED ALLOY (GAS-ATOMIZED POWDERS)											
Stellite™ alloy 1	Bal.	30	13	2.5	<2.0	<1.0	<2.0	<2.0	<1.0	R30001	51–60
Stellite™ alloy 4	Bal.	30	13.5	0.7	<2.5	<1.0	<2.5	<1.0	<1.0	R30404	40–50
Stellite™ alloy 6	Bal.	28.5	4.6	1.2	<2.0	<1.0	<2.0	<2.0	<1.0	R30106	40–46
Stellite™ alloy 6LC	Bal.	29	4.5	1.1	<2.0	<1.0	<2.0	<2.0	<1.0	—	38–44
Stellite™ alloy 6HC	Bal.	28.5	4.6	1.35	<2.0	<1.0	<2.0	<2.0	<1.0	—	43–53
Stellite™ alloy 156	Bal.	28	4	1.7	<2.0	<1.0	<0.5	<2.0	<1.0	—	46–54
Stellite™ alloy 12	Bal.	30	8.5	1.45	<2.0	<1.0	<2.0	<2.0	<1.0	R30012	43–53
Stellite™ alloy 20	Bal.	32.5	17.5	2.55	<2.0	<1.0	<2.0	<1.0	<1.0	—	52–62
Stellite™ alloy 21	Bal.	27.5	—	0.25	2.6	5.4	<2.0	<2.0	<1.0	R30021	27–40 *
Stellite™ alloy 22	Bal.	28	—	0.30	1.5	12	<3.0	<2.0	<0.5	—	41–49 *
Stellite™ alloy 25	Bal.	20	15	0.1	10	<1.0	2	<1.0	1.9%Mn	—	20–45 *
Stellite™ alloy 31	Bal.	26	7.5	0.5	10.5	<1.0	<2.0	<1.0	<0.5	R30031	20–35 *
Stellite™ alloy F³	Bal.	26	12.5	1.8	22	<1.0	<2.0	1.1	<0.5	R30002	40–45
Stellite™ alloy 190	Bal.	26	14	3.4	<2.0	<1.0	<2.0	<1.0	<1.0	R30014	55–60
Stellite™ alloy 250	Bal.	28	<1.0	0.1	<1.0	<1.0	20	<1.5	<1.0	—	20–28
Stellite™ alloy 694	Bal.	28.5	19.5	0.9	5	—	<3.0	<1.0	1%V	—	46–52
Stellite™ alloy 706	Bal.	29	—	1.25	<2.0	4.5	<2.0	<1.0	<1.0	—	39–44
Stellite™ alloy 712	Bal.	29	—	2.0	<2.0	8.5	<2.0	<1.0	<1.0	—	46–53
ULTIMET™ **	Bal.	26	2	0.07	9.4	5	3	<1.0	<1.0	R31233	20–45 *
COBALT-BASED TRIBALOY™ ALLOYS (GAS-ATOMIZED POWDERS)											
Tribaloy™ alloy T-400	Bal.	8.5	—	<0.08	<1.5	29	<1.5	2.8	<1.0	R30400	51–57
Tribaloy™ alloy T-400C	Bal.	14	—	<0.08	<1.5	27	<1.5	2.6	<1.0	—	51–57
Tribaloy™ alloy T-401	Bal.	17	—	0.2	<1.5	22	<1.5	1.3	<1.0	—	45–50
Tribaloy™ alloy T-800	Bal.	17	—	<0.08	<1.5	29	<1.5	3.7	<1.0	—	53–61
Tribaloy™ alloy T-900	Bal.	18	—	<0.08	16	23	<1.5	2.8	<1.0	—	48–55
NICKEL-BASED SUPERALLOYS (GAS-ATOMIZED POWDERS)											
Nistelle™ alloy "Super C"	—	23	—	0.1	Bal.	18	<1.0	<1.0	—	—	15–25 *
Nistelle™ alloy C	—	17	4.5	0.1	Bal.	17	6	<1.0	0.3%V	—	17–27 *
Nistelle™ alloy C4C	—	16	—	—	Bal.	16	<1.0	<1.0	—	N06455	
Nistelle™ alloy C22	<2.0	21.5	3	—	Bal.	13.5	4	—	0.15%V	—	
Nistelle™ alloy C276	—	15.5	3.7	—	Bal.	16	5.5	<1.0	0.15%V	—	
Nistelle™ alloy X	1.5	22	<1.0	0.15	Bal.	9.1	18.5	<1.0	<1.0%	N06002	
Nistelle™ alloy 305	—	42	—	—	Bal.	—	—	0.5	<1.0%	—	
Nistelle™ alloy 2315	—	20	—	—	Bal.	—	—	<1.0	<1.0%	—	
Nistelle™ alloy 600	—	15.5	—	—	Bal.	—	8	<0.5	<1.0%	N06600	
Nistelle™ alloy 625	—	21.5	—	<1.0	Bal.	9	<1.0	<0.5	3.5% Nb	N06625	
Nistelle™ alloy 718	<2.0	21.5	3	—	Bal.	13.5	4	—	0.15%V	N07718	

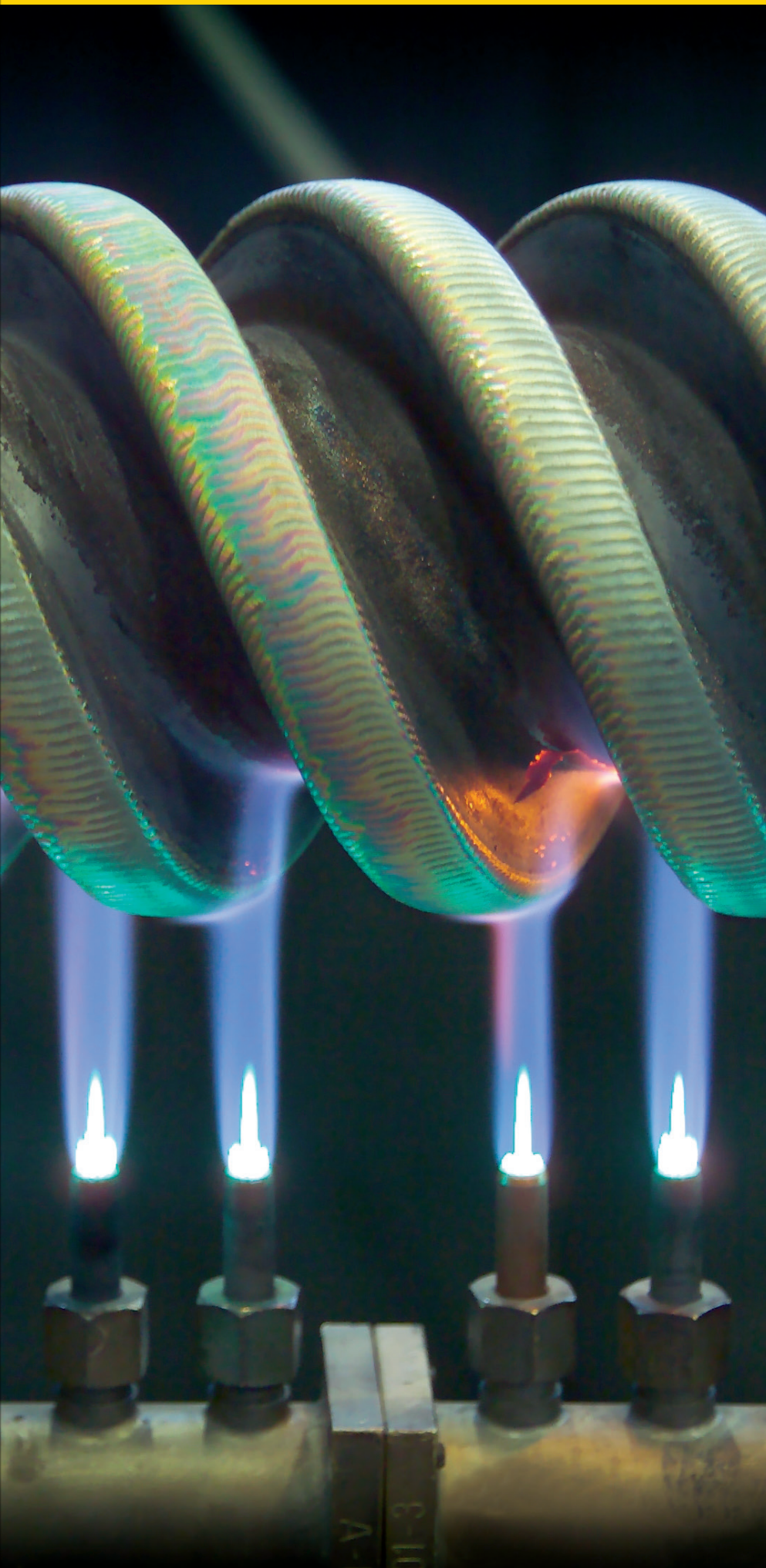
¹ Nominal analysis is a guideline only for standard product. Does not include all incidental elements and may differ depending on the exact specification/standard used when ordering.

² Undiluted weld metal.

³ Stellite™ Alloy F usually made to customer specification.

* Depending upon the degree of work hardening.

**ULTIMET™ is a registered trademark of Haynes International.



Professional Surfacing

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