

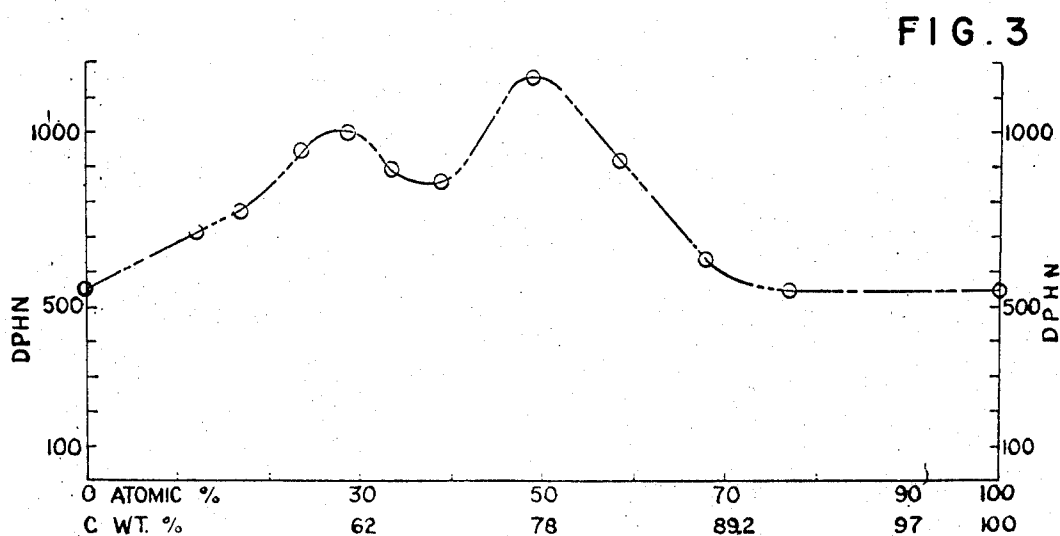
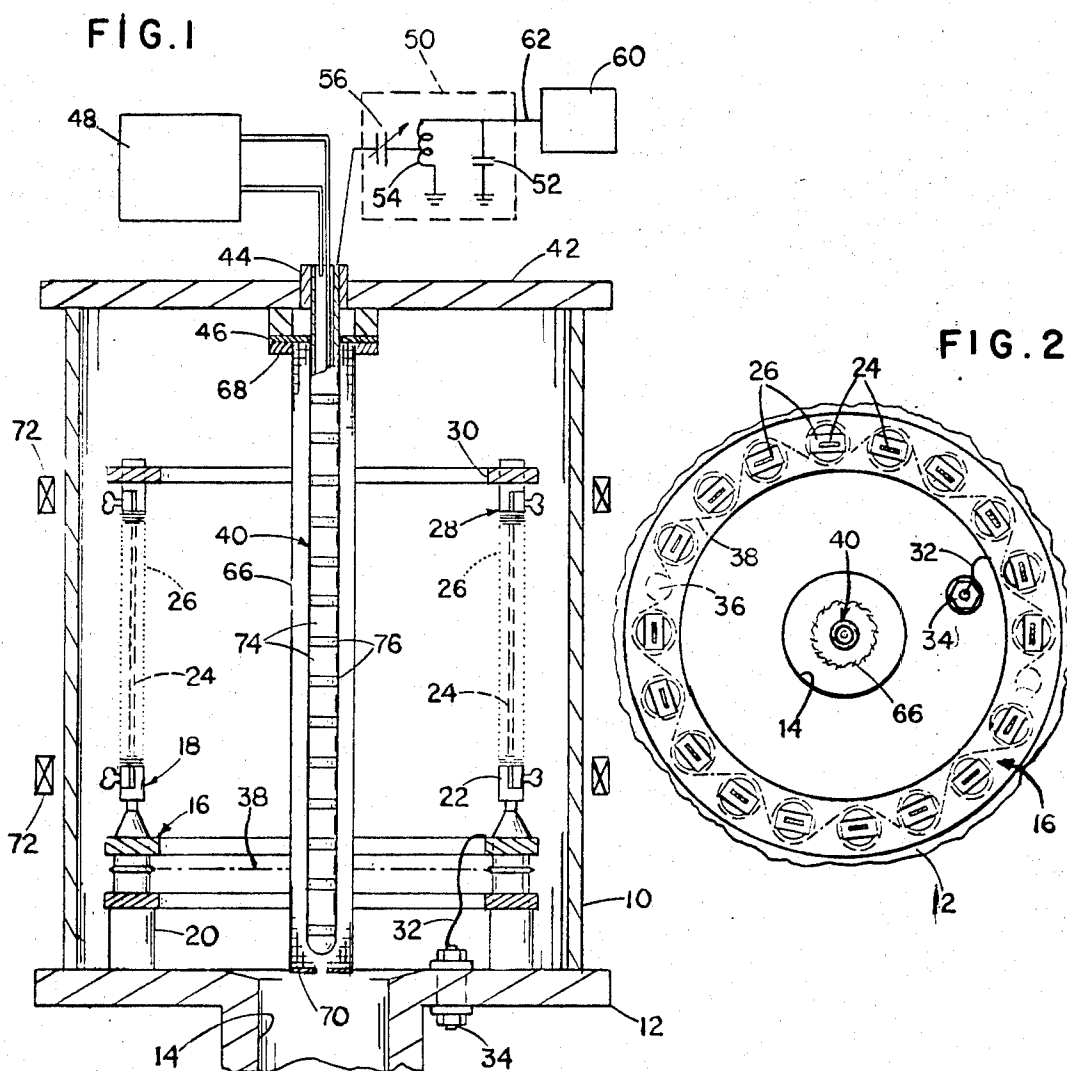
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3,725,238

TARGET ELEMENT

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3,725,238

TARGET ELEMENT

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Continuation-in-part of application Ser. No. 865,634, Oct. 13, 1969, which is a continuation-in-part of application Ser. No. 845,142, July 28, 1969. This application June 19, 1970, Ser. No. 47,664

Int. Cl. C23c 15/00

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5 Claims

ABSTRACT OF THE DISCLOSURE

A target element for use in an RF sputtering system for forming a thin film metal alloy on the surface of a substrate. The target element is in the form of an elongated rod and its exposed surface is composed of alternating bands of first and second metals in metallurgically separate form from one another.

This application is a continuation-in-part of our co-pending patent application Ser. No. 865,634, now abandoned, filed Oct. 13, 1969 and entitled "Razor Blades," which in turn was a continuation-in-part of our co-pending patent application Ser. No. 845,142, filed July 28, 1969 and entitled "Razor Blades," now Pat. No. 3,682,795.

SUMMARY OF INVENTION

This invention relates to RF sputtering apparatus and more particularly to target elements useful for providing articles with protective metal layers which have excellent corrosion and wear resistant characteristics.

Frequently the surface of an article requires protection against both mechanical wear and corrosion. Such surfaces include the interiors of piston chambers, for example in internal combustion engines; and surfaces of devices such as pumps or valves that are inserted into the human body. In the latter case, the device must operate reliably and without significant mechanical wear for years and not corrode or contaminate the system in which it is disposed.

Another such surface is the cutting edge of a razor blade which is sharpened with precision and is subjected both to corrosive atmospheres and to substantial mechanical force during shaving. The faces or sides of cutting edges of razor blades extend back from the ultimate edge and may comprise two or more "facets" formed by successive grinding or honing operations and intersecting each other along zones generally parallel to the ultimate edge. The final facet, that is the facet immediately adjacent the ultimate edge, may have a width of as little as 0.0003 inch or even less, while the thickness of the ultimate edge is generally less than 6000 Å. and preferably less than 2500 Å. Due to its thinness, the ultimate edge is extremely susceptible to mechanical failure and, particularly in the case of carbon steel, to corrosion failure. It has been proposed to apply a coating of a corrosion resistant metal such as gold, rhodium or chromium to the sharpened edge of a razor blade by evaporation or sputtering. However, noble metals have not been satisfactory as they tend to break away from the underlying shaving edge under the abrasion forces encountered in shaving, such tendency rendering the blades commercially unsatisfactory. Further, a shave facilitating polymeric fluorocarbon coating is frequently cured on the blade edges by exposing the blades to elevated temperatures, e.g., 550° F. to 800° F. Such temperatures have a softening effect on the underlying blade metal, which softening adversely effects the shaving properties of the blades. In the case of razor blades, therefore, the metal film, in addition to having hardness and corrosion resistance characteristics, should

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maintain significant hardness at fluorocarbon sintering temperatures even though the underlying steel softens, should have adhesion compatibility with both the underlying steel and the overlying polymeric coating so that all the layers remain firmly adhered to one another throughout the shaving life of the blade and should not otherwise have an adverse effect on shaving characteristics.

It is a general object of this invention to provide novel and improved target elements for use in RF sputtering systems.

A further object of the invention is to provide novel and improved apparatus for providing an article having superior wear and corrosion resistant properties.

Another object of the invention is to provide novel and improved apparatus for improving the wear and corrosion resisting properties of a substrate in a mass production process and in a manner that does not impair the quality of the underlying substrate.

Another object of the present invention is to provide novel and improved apparatus for providing a metal film on a razor blade which has improved corrosion resisting properties, which is firmly adherent to the surfaces of the blade edge and which provides a sturdy and compatible base for polymeric coatings which are formed at elevated temperatures.

In accordance with the invention there is provided a target element for use in an RF sputtering system. The target element is in the form of an elongated rod and its exposed surface consists solely of two metals that are arranged in alternating bands. In preferred embodiments, a first metal is selected from the class consisting of iridium, osmium, platinum, rhenium, rhodium and ruthenium (hereinafter termed an N metal) and a second metal is selected from the class consisting of chromium, manganese, niobium, molybdenum, tantalum, titanium, tungsten, vanadium and an N metal different from the other metal of the alloy (hereinafter termed a strengthening metal); the class consisting of chromium, molybdenum, niobium, tantalum, vanadium and an N metal being a preferred class. Particularly advantageous are those target rod surface configurations that form an intermetallic compound of the M_3N type with the ordered A15 cubic structure and alloy compositions around those compounds, that is within about ± 5 weight percent of these compounds, those alloys having excellent heat stability.

In the case of platinum-chromium alloys, a preferred range of platinum area is 15–30 percent of the total exposed area and where the environment of use is particularly corrosive it is preferred that the platinum content of the deposited alloy be at least 21 atomic percent.

Alloys manufactured with the invention have a micro hardness greater than 750 DPHN and an extremely fine grained structure, the crystallite size, as determined by electron microscopy or electron diffraction techniques, being less than one thousand angstroms. For example, the crystallite size of thin film platinum-chromium alloys manufactured with the invention in as sputtered condition is less than fifty angstroms. Substrates having alloy deposited on them with the invention exhibited no sign of corrosion after immersion in concentrated hydrochloric acid for one minute. A platinum-chromium alloy deposited with the invention having a platinum content of 21 atomic percent has a dissolution rate in boiling hydrochloric acid of 0.008 mil per minute, which may be contrasted with a dissolution rate of 1000 mils per minute for pure chromium in boiling hydrochloric acid. In typical applications, the alloy film deposited with the invention is at least fifty angstroms in thickness, is continuous, and is of uniform thickness.

Where the substrate is the sharpened edge of a steel razor blade, the M_3N compound is particularly ad-

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vantageous as it has greater heat stability than the underlying steel. For example, the hardness of a Cr₃Pt alloy film deposited on a razor blade with the invention is substantially independent of heat treatment temperatures up to 1200° C. In such a platinum-chromium alloy film, a preferred range of platinum content of the film is 15-30 atomic percent and particularly advantageous results are obtained with a film having a platinum content of 21-27 atomic percent. The alloy film is at least as hard as the underlying blade metal and should not exceed 600° A. in thickness, a preferable range being 50-500 A. and the best results being obtained with a thickness in the range of 100-400 A. Further, where a fluorocarbon shave facilitating coating is utilized, alloy films that employ either chromium or an N class metal as the strengthening metal provide most satisfactory coating adherence. In cases where the adhesion of the fluorocarbon coating to the alloy appears to be inadequate, (i.e., W-Pt) the benefits of the hard alloy coating can be obtained by the use of a very thin (about 75 A. or less) overlayer of the Cr₃Pt alloy as an interfacial bonding agent.

In the manufacture of razor blades, the alloy film should be applied with processes and apparatus that permits production of large quantities of razor blades with a minimum of additional processing steps, and accordingly, a further object of the invention is to provide novel and improved apparatus for placing a metal alloy film having superior corrosion resistant properties on the sharpened edges of razor blades with controlled uniformity.

Another object of the invention is to provide novel and improved apparatus for placing a film of improved corrosion resistant alloy on the sharpened edges of razor blades in a mass production process and in a manner that does not impair the quality of the sharpened edges.

Still another object of the invention is to provide a novel and improved apparatus for use in a commercial production blade treatment system in which the sharpened edges of razor blades are cleaned and a thin film of a corrosion resistant metal alloy that is at least as hard as the underlying blade metal is applied to the cleaned sharpened blade edges.

A blade treatment system in accordance with the invention includes an evacuable chamber in which is disposed structure for receiving one or more stacks of razor blades, the blades in each stack being disposed in face to face relationship with their sharpened edges in alignment. Also disposed within the chamber is an elongated source rod of metal that extends along a line parallel to the exposure axis of each razor blade stack. The source rod includes an N metal and a strengthening metal in metallurgically separate form from the N metal. The source rod may take various forms, for example it may be a sintered compact of the metals of which the alloy is to be formed, or an assembly of one or more segments of the strengthening metal component of the alloy, to which appropriately spaced segments of the N metal component of the alloy are secured. In processing the blades, after the blade edges are cleaned in the vacuum chamber, the metal source rod is energized in a reduced pressure gaseous environment to transfer the metals from the source and form on the blade edges a thin film alloy of the metals of the source. A preferred method of forming the alloy film on the blade edges is to subject the composite metal source rod to an ion bombardment process to transfer metal atoms to the sharpened blade edges. Where a fluorocarbon polymer is subsequently sintered on the alloy film, an inert gas such as argon or nitrogen is preferably employed as the sintering atmosphere, although other sintering atmospheres, such as cracked ammonia or hydrogen may be utilized, particularly with alloys with relatively small amounts of the N metal.

This invention is particularly useful in providing an improved thin protective metal alloy film on the sharpened edges of razor blades, which thin film does not have an adverse effect on shaving characteristics of the blade and

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which does not require further mechanical working of the blade edge area to provide satisfactory first shave quality. A wide range of blade materials may be used, specific razor blade steel compositions with which the invention may be practiced including the following:

COMPOSITION IN PERCENT

C	Cr	Mo	Si	Ni
1.25	.2	-----	.2	-----
1.00	6.0	-----	1.4	-----
.96	13.9	-----	.3	-----
.65	10.5	1.0	.3	-----
.58	14.0	-----	.3	-----
.40	13.5	1.25	.3	-----
.09	17.0	.70	1.2	8.0

The preferred metal alloy coatings deposited on the edges of the blades with the invention are significantly harder than the blade bodies (having micro hardnesses of up to about 1700 DPHN), remain harder than prior art commercial blades after the blades are subjected to polymer curing temperatures in the range of 550-800° F., and have excellent corrosion resistance.

Other objects, features and advantages of the invention will be seen as the following description of particular embodiments of the invention progresses, in conjunction with the drawings, in which:

FIG. 1 is a sectional view of a form of apparatus employed in the invention;

FIG. 2 is a sectional view of the apparatus shown in FIG. 1, taken along the line 2-2 of FIG. 1; and

FIG. 3 is a graph indicating characteristics of an alloy deposited in accordance with the invention.

DESCRIPTION OF PARTICULAR EMBODIMENTS

The sputtering (ion bombardment) apparatus shown in FIG. 1 includes a stainless steel cylinder 10 eighteen inches in diameter and thirty-two inches high mounted on base 12. Base 12 is coupled through port 14 to a suitable vacuum system (not shown). A butterfly valve that has an aperture one inch in diameter is disposed downstream of port 14 and may be moved to closed position during sputtering to reduce back streaming of the diffusion pump. Mounted in chamber 10 on ring assembly 16 for rotation about vertical axes are eighteen blade stack support structures 18. Assembly 16 is isolated electrically from base 12 by six post structures 20. Each blade stack support structure 18 includes a base structure 22 that has a recess for receiving the lower end of a relatively rigid elongated blade aligning leaf or knife 24 on which a stack of razor blades 26 is positioned. A clamping structure 28 at the upper end of knife 24 secured a stack of blades 26 in position on the knife and in turn is secured to an upper aligning ring 30. An electrical connection to the blade stacks 26 is made via conductor 32 and feed through connection 34 in the base 12. Drive shaft 36 is coupled to ring assembly 16 to rotate the blade stacks 26 via chain 38. In a typical processing run of double edged blades in this apparatus, each stack is twelve inches long and contains three thousand blades while in a typical processing run of single edge injector blades, each stack contains twelve hundred blades. The sharpened edges of the blades are 6¾ inches from the axis of chamber 10. Other support structures, such as those for coils of blade strip of the type disclosed in co-pending application S.N. 693,529, may be substituted for these support structures.

Also mounted within the chamber coaxially with the chamber axis is a target rod 40 that in a particular embodiment includes platinum and chromium. Rod 40 is suspended from chamber top plate 42 by insulator structure 44. A water cooled dark space shield 46, also suspended from top plate 42, is provided to protect insulator 44. The exposed length of target rod 40 below shield 46 is twenty-nine inches in one embodiment and twenty-eight inches in a second embodiment and that exposed length is positioned symmetrically with respect to the stacks of razor blades 26. In these embodiments the rod

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40 is 1¼ inches in diameter and has a wall thickness of ¼ inch. Coolant from a suitable source 48 is circulated through rod 40 for cooling purposes. Connected to the target rod 40 is a matching network 50 that includes fixed capacitor 52, inductor 54 (adjustable over the range 0–5 microhenrys) and capacitor 56 adjustable over the range 0–1000 picofarads), the matching network being connected to an RF (13.56 mHz.) voltage supply 60 via shielded conductor 62.

A stainless steel wire mesh cylinder 66, 3¼ inches in diameter with ⅛ inch apertures, is suspended from dark space shield 46 by flange 68 that is solidly bolted to shield 46. A stainless steel plate 70 is secured at the lower end of mesh cylinder 66. Two Helmholtz coils diagrammatically indicated at 72 surround chamber 10, one above and one below the blade stacks. These coils, when energized, create a vertical magnetic field of about 100 gauss magnitude in the chamber 10. The use of mesh cylinder 66 and the magnetic field increases the metal deposition rate and reduces secondary electron bombardment of the blades.

The target 40 may take a variety of forms. In one form the target may be a sintered compact of platinum and chromium. In a second form as indicated in FIG. 1, the target 40 is formed of alternating exposed sections of chromium 74, and platinum 76. In one embodiment, strips of platinum ribbon, each strip being 0.002 inch thick, ½ inch wide and four inches long, are disposed in annular grooves in a chromium rod to form rings 76 which are spot welded to the rod. The rings 76 are equally spaced from one another and in the illustrated embodiment, the exposed surface area of this target assembly is 19% platinum and 81% chromium.

In operation of this apparatus, the sharpened blades 26 in stacks, are placed in the chamber on knives 24. The chamber is evacuated and argon at a pressure in the range of 10 microns is placed in the chamber. The blades are then energized with a DC potential applied through connection 34 (the tank being grounded) and cleaned by glow discharge for five minutes. After cleaning, the chamber is evacuated and argon at pressure of 5–8 microns is placed in the chamber. With the blade stacks and chamber grounded, a potential is applied from power supply 60 to target 40. Argon ions are produced which bombard target 40 and release atoms of the two metals. The released atoms are deposited on exposed surfaces, including the sharpened blade edges. This operation with an elongated target rod and plural blade stacks forms an easily controlled platinum-chromium alloy coating uniformly on the blade edges to thicknesses of less than 600 Å. The alloy composition is a direct function of the exposed surfaces of the metals in the target rod. Thus, with the specific target rod configuration shown in FIG. 1 an alloy composition close to the platinum-chromium compound Cr₃Pt is deposited, the alloy having about 55 weight percent (24 atomic percent) platinum. Deposition rates are a function of applied power. For example, an input power of two kilowatts provides a deposition rate of 50 Å./minute while an input power of five kilowatts provides a deposition rate of 150 Å./minute.

The graph of FIG. 3 shows micro hardness (using a Vickers diamond needle with a two hundred gram load and converted to DPHN) of platinum-chromium alloys of differing compositions deposited by sputtering on a planar substrate to a thickness of 0.0015 inch in accordance with the invention, the graph being a plot of hardness as a function of the platinum content of the bulk sputtered alloy. The hardness of the alloys in the vicinity of the intermetallic compound Cr₃Pt (twenty-five atomic percent platinum), which compound has the A15 cubic crystalline structure, remains stable and is substantially independent of heat treatment up to 1200° C. The fifty atomic percent chromium-platinum alloy is disordered as sputtered in a thin film but undergoes ordering on heating with a significant increase in strength, the hardness

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peak at about 50 atomic percent platinum being due to the heating to which the material was subjected during the bulk sputtering of the layer to a thickness of 0.0015 inch.

As a specific example, sixty thousand stainless steel razor blades having the following composition:

	Percent
Carbon -----	.54-.62
Chromium -----	13.5-14.5
Manganese -----	.20-.50
Silicon -----	.20-.50
Phosphorus, max. -----	.025
Sulphur, max. -----	.020
Nickel, max. -----	.50
Iron -----	Remainder

were sharpened to an included solid angle of 24.8° and placed on eighteen knives 24.

The pressure in the chamber was reduced to 0.1 micron and a discharge sustaining atmosphere of argon was then bled into the chamber to increase the pressure to ten microns. A direct current glow discharge was initiated in this argon atmosphere at a voltage of 1600 volts and a current of 1100 milliamperes and maintained for five minutes. The blade stacks 24 were then connected to ground and four kilowatts of RF power (at a frequency of 13.56 megacycles and at a D.C. negative bias of about 900 volts with a superimposed RF signal of about 1000 volts peak to peak) was applied to rod 40 with the matching network adjusted for zero reflected power for four minutes. The RF power was applied ten seconds before application of the D.C. power was entirely terminated and was increased gradually to four kilowatts as the D.C. power was being reduced. The Helmholtz coils 72 were energized at the same time that the RF power was initially applied. After the end of the four minute sputtering interval the blade stacks were turned and the above described cleaning and sputtering steps were repeated. The resulting platinum-chromium alloy coating had a hardness of about 960 DPHN and a thickness of about 350 Å. and extended along the entire cutting edge of the blades and back along the final facet for a length of at least 0.001 inch. A coating of polytetrafluoroethylene telomer was then applied to the edges of the blades in accordance with the teaching in copending application Ser. No. 384,805, filed July 23, 1964 in the name of Irwin W. Fischbein, now U.S. Pat. No. 3,518,110 of June 30, 1970. This processing involved heating the blades in an argon environment to a temperature preferably in the range of 590–806° F. and provided on the cutting edges of the razor blades an adherent coating of solid fluorocarbon polymer. After heating the equivalent hardness of the edge metal (the composite of the thin alloy film and the underlying blade metal) was 700 DPHN. These blades exhibited excellent shaving properties and long shaving life.

As a second example, a pure chromium disc six inches in diameter and ¼ inch thick had spot welded to its surface squares of pure platinum foil 1 cm. on a side and 0.002 inch thick. These foil squares were spaced on the surface so that 27% of the chromium surface was covered with platinum. A 4½ inch stack of stainless steel blades was placed on a five inch diameter aluminum disc in the RF sputtering unit. (This apparatus may also be used for processing a coiled stack of blade strip with the strip placed on the aluminum disc so that the sharpened edges of the strip are aligned with one another and define an exposure axis.) The platinum-chromium disc surface was disposed parallel to the blade edges at a distance of 2½ inches. The RF power could be fed to the plat supporting the blades or to the platinum-chromium plate above the blade stack. The pressure in the vacuum chamber was reduced to 0.1 micron of mercury and then pure argon gas was bled into the chamber to a pressure of ten microns of mercury. The aluminum disc and blades were then cleaned for two minutes with 0.2 k.w. of RF power (at 13.56

megacycles with a D.C. negative bias of about 2500 volts and a superimposed RF signal of about 3300 volts peak to peak). The platinum-chromium target was covered by a metal shield during this cleaning step. The shield was then placed so that the blades were shielded and the platinum-chromium target plate was cleaned with an applied power of 0.4 kw. (at 13.56 megacycles with a D.C. negative bias of about 3400 volts and a superimposed RF signal of about 4500 volts peak to peak), for one minute, while maintaining ten microns of mercury pressure of argon gas. The shield was then removed from between the blades and the platinum-chromium target. Sputtering (ion bombardment) of the target now proceeded at 0.4 kilowatt for one minute and forty seconds. The edges of the blades facing the target received a platinum-chromium alloy coating consisting of 58 weight percent platinum

osition of osmium was left exposed. This osmium-chromium target was used in the same apparatus as used in the second example. The aluminum disk and blades were cleaned for two minutes with an RF power of 0.2 kilowatts; the osmium-chromium target was then presputtered for one minute at an applied RF power of 0.4 kilowatt; and then sputter deposition proceeded for two minutes at an RF power of 0.4 kilowatt. The edges of the blades facing the target received an osmium-chromium alloy coating consisting of 32 atomic percent osmium and 68 atomic percent chromium to a thickness of 250 angstroms. The blades were then coated with a thin film of PTFE telomer and exhibited excellent shaving properties.

Other examples of the invention utilizing the same equipment as in the second example are summarized in the following table:

Alloy	Target composition	Processing			Film		Hardness
		Cleaning	Presputtering	Sputtering	Thickness (A.)	Composition	
Iridium-chromium.....	{71.7% chromium..... 28.3% tungsten.....}	RF, 0.2 kw., 2 mins.	RF, 7 mins., 0.4 kw.	RF, 75 secs., 0.4 kw.	250	{69% chromium..... 31% iridium.....}	1,700
Platinum-tungsten *	{91% tungsten..... 9% platinum.....}	RF, 0.2 kw., 2 mins.	RF, 3 mins., 0.4 kw.	RF, 100 secs., 0.4 kw.	250	{84% tungsten..... 16% platinum.....}	-----
Iridium-platinum.....	{79% iridium..... 21% platinum.....}	RF, 0.2 kw., 2 mins.	RF, 5 mins., 0.4 kw.	RF, 75 secs., 0.4 kw.	320	{75% iridium..... 25% platinum.....}	1,300
Iridium-vanadium *	{84.8% vanadium..... 15.2% iridium.....}	DC, 2,000 volts, 25 ma., 7 mins.	RF, 6 mins., 0.4 kw.	RF, 120 secs., 0.4 kw.	200	Van.....	1,300
Iridium-tantalum *	{86% tantalum..... 14% iridium.....}	RF, 0.2 kw., 2 mins.	RF, 8 mins., 0.4 kw.	RF, 120 secs., 0.4 kw.	240	Ta ₃ Ir.....	1,450
Ruthenium-chromium.....	{71% chromium..... 29% ruthenium.....}	DC, 2,000 volts, 25 ma., 7 mins.	RF, 5 mins., 0.4 kw.	RF, 100 secs., 0.4 kw.	250	{71% chromium..... 29% ruthenium.....}	1,200

and 42 weight percent chromium to a thickness of about 250 A. and a hardness of about 800 DPHN. These blades, when coated with a thin film of a PTFE telomer in the same manner as in the previous example exhibited excellent shaving properties.

As a third example, a titanium disc 1/8 inch thick and three inches in diameter (appropriate dark space shielding producing an effective disc diameter of 2 5/8 inches) had spot welded to its surface squares of pure platinum foil 1/2 cm. on a side and 0.010 inch thick. These foil squares were placed on the surface of the disc so that 8% of the titanium surface was covered with platinum. A stack of one hundred stainless steel blades was placed on a water cooled five inch diameter aluminum disc in an RF sputtering unit. The platinum-titanium disc surface was disposed parallel to the blade edges at a distance of 2 1/2 inches. A shutter was interposed midway between the blades and the platinum-titanium disc. An environment of argon gas at a pressure of 10 microns of mercury was placed in the vacuum chamber. The aluminum disc and blades were then cleaned for two minutes at 0.2 kilowatt of RF power at 13.56 MHz. (with a D.C. negative bias of about 2500 volts and a superimposed RF signal of about 3300 volts peak to peak), during which interval the platinum-titanium target was shielded by the shutter. The target was then presputtered with an applied power of 0.8 kilowatt (at 13.56 megacycles with a D.C. negative bias of about 4200 volts and a superimposed RF signal of about 500 volts peak to peak) for ten minutes while maintaining the pressure of the argon gas in the chamber at ten microns of mercury. The shutter was then removed from between the blades and platinum-titanium target and a platinum-titanium alloy was deposited on the blade edges by sputtering at 0.8 kilowatt applied power for minutes. The coating was a platinum-titanium alloy consisting of twenty-four atomic percent platinum and seventy-six atomic percent titanium and had a thickness of about 350 A. and was harder than the underlying blade metal. These blades, when coated with a suitable interfacial bonding layer and a thin film of PTFE telomer exhibited excellent shaving properties and long shaving life.

In a fourth example, a brass target six inches in diameter was osmium plated. Chromium was then sputtered onto the target through a mask so that ten square inches of osmium appropriately spaced to provide uniform dep-

The alloys indicated by an asterisk exhibited inferior adhesion compatibility with the PTFE telomer. Satisfactory adhesion was achieved by depositing an interfacial layer of Cr₃Pt on those alloys. After sputter deposition of the alloy, a chromium disc with platinum squares spot welded to it was substituted for the target in the deposition chamber. The blades with the alloy film were cleaned for thirty seconds at 0.2 kw. RF power; the substituted target was presputtered for ten seconds at 0.4 kw. RF power; and then the Cr₃Pt alloy was sputter deposited for thirty seconds at 0.4 kw. RF power, forming a 75 A. interfacial bonding layer for the PTFE telomer, the blades so treated exhibited excellent shaving properties and long shaving life.

While particular embodiments of the invention have been shown and described, various modifications thereof will be apparent to those skilled in the art and therefore it is not intended that the invention be limited to the disclosed embodiment or to details thereof and departures may be made therefrom within the spirit and scope of the invention.

What is claimed is:

1. A target element for use in an RF sputtering system for forming a thin film metal alloy on the surface of a substrate, said target element being in the form of an elongated rod, the exposed surface of which consists solely of first and second metals in metallurgically separate form from one another, said first and second metals being arranged in alternating bands said first metal being selected from the class consisting of iridium, osmium, platinum, rhenium, rhodium, and ruthenium (herein termed an N metal) and said second metal being selected from the class consisting of chromium, manganese, molybdenum, niobium, tantalum, titanium, tungsten, vanadium and an N metal different from said first metal.

2. The target element as claimed in claim 1 wherein the exposed surface areas of said first and second metals are proportioned so that the composition of the alloy formed on said substrate is an intermetallic compound of the M₃N type or a composition within about ± 5 weight percent of that compound where M is said second metal and N is said first metal.

3. The target element as claimed in claim 1 wherein said first metal is selected from the class consisting of

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iridium, osmium and platinum and said second metal is chromium.

4. The target element as claimed in claim 1 wherein said second metal forms a base segment and a plurality of spaced segments of said first metal are secured in bonded relation to said base segment.

5. The target element as claimed in claim 1 wherein said first metal is platinum and said second metal is chromium, the exposed surface area of platinum being 15-30 percent of the total exposed surface area.

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