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Data-Base System of Tribological Coating Materials

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Abstract

This work presents a data-base tribological coating model for many coatings, their properties, composition, and applications. By using this data base system any coating material and its properties can be investigated by making some queries by any user so that the search for any coating material needed for some application becomes easy which saving time and effort. The new data-base model gives flexibility for users to find suitable coatings for specific application.

Keywords: tribological coating, data-base system, query, materials, CVD, PVD

INTRODUCTION

Tribology is the field of science and technology dealing with contacting surfaces in relative motion –which means that it deals with phenomena related to friction, wear and lubrication .Tribology played a central role in early technological evolution, even in ancient times .Reducing friction by using wheels made it possible for humans to move further and faster, and the lubrication of sleds made it possible to transport building blocks and raise large structures .Together with good tribological engineering knowledge, metal as a construction material and oil as a lubricant eventually smoothed the path for the modern industrial revolution, and allowed new inventions like high strength and low friction bearings and gears that were key components in high power machinery. In modern industrialized societies there is a growing need to reduce or control friction and wear for several reasons, for example to extend the lifetime of machinery and bio-systems, to make engine sand devices more efficient, to develop new advanced products, to conserve scarce material resources, to save energy, and to improve safety.[1].

Historically these aims have been achieved by design changes, selecting improved bulk materials, or by utilizing lubrication techniques .Bulk material changes might involve applications with ceramics or polymers .The lubrication techniques would include the use of liquid lubricants such as mineral or synthetic oils or solid lubricants such as molybdenum disulphide. Recently, tribologists have made increasing use of another approach to friction and wear control –that is to utilize surface treatments and coatings .This has led to, and to some extent been fuelled by, the growth of a new discipline called surface engineering .This growth has been encouraged by two main factors .The first has been the development of new coating and treatment methods, which provide coating characteristics and tribo-chemical properties that were previously unachievable .The second reason for the growth in this subject area has been the recognition by engineers and materials scientists that the surface is the most important part in many engineering components .It is at the surface that most failures originate, either by wear, fatigue or corrosion .The surface has a dominant influence on lifetime cost and performance, including machinery maintainability. The surface may also have other functionally important attributes, not confined to mechanical or chemical properties, such as thermal, electronic, magnetic and optical characteristics that influence the choice of surface material .The retention of these physical surface properties is clearly essential throughout the life of the product .It is a further reason why surface durability enhancement by appropriate coating selection is critical to any product's effectiveness, and therefore its saleability in the marketplace.[1,2].

Many researches discussed coatings and their properties and applications, Norman A. (2004), discussed the issue of Preventing or lessening the wear of mechanical components continues to be a much sought after goal of engineering and product development. Lessening wear that results from contact of two materials might be accomplished by changing one or both of the materials. However, in many instances this may not be not possible, because both materials must meet other requirements of strength, flexibility, or environmental resistance. In these cases, changing the surface properties of one or both materials may be the answer. This brief overview cannot attempt to present all the possible means of modifying a surface, such as annealing or ion implantation. One common and useful method of surface modification is deposition of a Tribological coating. The article didn't attempt to cover all possible tribological coatings, but a few selected examples of coatings deposited by physical vapor deposition (PVD) techniques will illustrate the usefulness of this method for product development.[2].

Woydt M. (2000), A numerical, tribological data collection system with 15,000 data records was developed to find materials for tribological operations. The database enables the user to search, retrieve and display information and data about the appropriate material couples in a fast and convenient way. The database is intended to be used by researchers, engineers, consultants and developers. All tribological characteristics of the listed materials are directly comparable; the data has been compiled and put into a standardized form, which covers the specific properties of nearly all tribometers used. The structure and the precisely defined formats may help guide future scientists and engineers to organize, archive and publish their tribological tests and results in a complete and comprehensive way.[3].

Sedlaček, M. et. al. (2004), they designed a database, in which data about mechanical and tribological properties of coatings and base materials, as well as test conditions were collected. Database is constructed in such a way that new data can be added easily. Practicability of the database was checked on pin on disc contact tests using different contact conditions. The main purpose of building the database was to examine the scientific and practical value of the numerous research results about DLC coatings and to find out in which extent these data are comparable with each other. Analysis of the database showed that it allows fast search and comparison between different research results.[4].

Yuriy K. et al.(2010), The main objectives of this study were the strategy and methodology for selecting the optimal surface treatment for a given tribological application. The classification of the main methods of the coating processes and the surface modification is given and the scheme of the development of the operation technology of the surface treatment and coating deposition is proposed. The main initial data are: the structure of tribological system (TrS); the individual properties of the TrS parts; the lubricant properties; the method of lubrication of the TrS parts; the properties of the surrounding environment; the external influences on the TrS; the technological limitations on the TrS parts treatment; and the managerial and economic limitations. The selection of the surface technology method includes the following steps: the preliminary analysis of the TrS part interaction; the development of models of friction and the wear process of the TrS parts; the choice of rational values of the parameters of the surface layers of the TrS parts; the choice of the rational composition and the structure parameters of the surface layers of the TrS parts; the choice of a rational technological route and the methods of the surface treatment of the TrS parts; the experimental examination of surface-strengthened materials and the TrS and the correction of the surface-treatment technology.[5].

Ramanathan, K. et. al. (2008), Artificial Neural Network (ANN) and regression models (a mathematical model) were used to predict the volume percent incorporation of diamond in the Ni-diamond metal matrix. Also Volume fraction of diamond deposition (Vfd) was taken as response variable (output variable) and current density, pH and temperature were taken as input variables. The prediction of response variable was obtained with the help of empirical relation between the response variable and input variables using ANN and also through DOE. The predicted values of the responses by ANN and regression models were compared with the experimental values and their closeness with the experimental values was determined.[6].

To meet the tribological requirements, the coated surface must possess a suitable combination of properties, for example in terms of hardness, elasticity, shear strength, fracture toughness, thermal expansion and adhesion. The properties required by the substrate and by the coating involve material strength and thermal attributes determined by their composition and microstructure as well as the porosity and homogeneity of the material .At the interface between them, the adhesion and shear strength of the junction is important .At the surface of the coating the chemical reactivity and the roughness must be considered in addition to the shear strength. The target of building the database system in this project using Microsoft access is to make searching about required information and properties of coating process more easy where the tables in the database contains the following data:

1- Film :thin film from coating material
2- Deposition method of coating
3- Substrates :sample part that we need coated .
4- Thickness of film
5- Roughness of film
6- Hardness of film
7- Material of counter- face
8- Roughness of counter-face
9-Hardness of counter-face

-RESULTS AND DISCUSSION: DATA BASE SYSTEM

Table 4.1-4.9 show the coatings data sheet for different types and their properties.

Table 4.1 Tribology data sheet for coatings :Carbides

	Film	Deposition r	Substrate	Thickness	Roughn R	hardness	Material	Roughness c	hardness co	ة حقل جديد
1	TiC	CVD	Steel	NA	0.1	na	,Tic,Tin,Alo,Sic	NA	NA	
2	SIC	CVD	steel	NA	0.1		sic,steel	NA	NA	
3	Cr7c3	CVD	steel	NA	0.1	NA	steel	NA	NA	
4	Tic	CVD	steel	4	NA	Na	steel 52100	Na	NA	
5	Tic(ball)	Ion platingPVD	steel	NA	NA	NA	el ,Tin on steel	0.02-0.04	NA	
6	Tic	CVD	steel	5	1700-2000	NA	Diamond stylus	NA	NA	
7	Tic	aporation =ARE	teel 4400C ball	4-8	0.3	2800-3000	steel ,Tic,Tin	0.1	3000,1800-2000	
8	Tic	CVD	steel	5	1	2000	steel	1.7	Na	
9	CrxCy	CVD	62 HRC	10	1	1500	steel	1.7	NA	
10	Tic	ve evaporation	nium ,titanium	4-6	0.1	3000	stainless steel	0.1	300	
11	Wc+Cr subl	PACVD	tool steel	16	NA	NA	steel,Tin+steel	52HRC	NA	
12	WC	tron sputtering	stainless steel	7	3200	Na	stainless steel	NA	NA	
13	CrC	gun plasmagun		20-100	NA	Na	Na	NA	NA	
14	BC	CVD	graphite	NA	NA	Na	l 42CD4,SiC,Alo	NA	Na	
15	Tic	CVD	205Cr,wMo121	5	2.7	NA	205Cr,WMo121	62HRC	NA	
0										

Table 4.2 Tribology data sheet for coatings :Diamond-like coatings

	Film	Deposition r	Substrate	Thickness	Roughn R	hardniss	Material cou	Roughn coi	hardness coi	حقل جديد
0										
1	a-C-h	plasma CVD	si3N4 flat	0.06	NA	NA	Si3N4	NA	NA	
2	a-C	arge pulse PVD	Wc-Co flat	0.5	NA	NA	steel Si3N4	NA	NA	
3	a-C-H	HFPVD	NA	0.5-2	NA	NA	St52100	NA	NA	
4	a-C-H	Dc plasma CVD	ed carbide flat	2	NA	NA	stMi-Mo	NA	NA	
5	a-H	a arc discharge	Na	3-4	NA	NA	steel	NA	NA	
6	a-CiSi-H	scharge PACVD	Na	2-3	0.1-0.3	NA	st52100	mirror	NA	
7	a-C-H	RF plasma PVD	NA	0.2	NA	NA	steel	NA	NA	
8	a-C-H	pulse PVD	NA	0.2-0.5	NA	NA	Quartz	NA	NA	
9	a-C	-discharge PVD	steel AISI316	1	0.03	NA	PTFE	NA	NA	
10	a-C-H	glow discharge	Si(100)	0.5	NA	NA	steel suj-1	NA	NA	
11	a-C	discharge PVD	steel	0.6	0.03	NA	st52100	NA	8.3 gpa	
12	a-C	discharge PVD	Wc-Co	1	NA	NA	si3N4	NA	NA	
13	a-C-H	licone oil IBAD	St52100	0.15	0.1	NA	st52100	NA	NA	
14	a-C-H	am deposition	Sic	2	NA	NA	si3N4	0.05	17gpa	
15	a-C-H	am deposition	Si	0.3	NA	NA	si3N4	NA	NA	
16	a-C	discharge PVD	Si	0.5	NA	NA	st52100	NA	NA	
17	ow-density DLC	discharge PVD	Sic	0.25-0.28	NA	NA	diamond	NA	NA	
18	a-C-H	plasma CVD	NA	NA	NA	NA	stainless steel	NA	NA	
19	a-C-H	FAB -EBPVD	ool steel ASP23	0.5	0.015-0.017	640	st52100	NA	NA	
20	a-C-H	plating laser	stainless steel	2	0.17	500	corundum	NA	NA	
21	a-C-H	RF plasma	stainless steel	0.5-1	0.03	620	steel-alumina	0.02	NA	

Table 4.3 Tribology data sheet for coatings :Polymers and elastomers

	Film	Deposition r	Substrate	Thickness	Roughn R	hardniss	Material cou	Roughn coı	hardness coı	حقل جديد
0										
1	a-C-h	plasma CVD	si3N4 flat	0.06	NA	NA	Si3N4	NA	NA	
2	a-C	arge pulse PVD	Wc-Co flat	0.5	NA	NA	steel Si3N4	NA	NA	
3	a-C-H	HFPVD	NA	0.5-2	NA	NA	St52100	NA	NA	
4	a-C-H	Dc plasma CVD	:ed carbide flat	2	NA	NA	stMi-Mo	NA	NA	
5	a-H	a arc discharge	Na	3-4	NA	NA	steel	NA	NA	
6	a-CiSi-H	scharge PACVD	Na	2-3	0.1-0.3	NA	st52100	mirror	NA	
7	a-C-H	RF plasma PVD	NA	0.2	NA	NA	steel	NA	NA	
8	a-C-H	pulse PVD	NA	0.2-0.5	NA	NA	Quartz	NA	NA	
9	a-C	-discharge PVD	steel AISI316	1	0.03	NA	PTFE	NA	NA	
10	a-C-H	glow discharge	Si(100)	0.5	NA	NA	steel suj-1	NA	NA	
11	a-C	discharge PVD	steel	0.6	0.03	NA	st52100	NA	8.3 gpa	
12	a-C	discharge PVD	Wc-Co	1	NA	NA	si3N4	NA	NA	
13	a-C-H	licone oil IBAD	St52100	0.15	0.1	NA	st52100	NA	NA	
14	a-C-H	:am deposition	Sic	2	NA	NA	si3N4	0.05	17gpa	
15	a-C-H	:am deposition	Si	0.3	NA	NA	si3N4	NA	NA	
16	a-C	discharge PVD	Si	0.5	NA	NA	st52100	NA	NA	
17	ɔw-density DLC	discharge PVD	Sic	0.25-0.28	NA	NA	diamond	NA	NA	
18	a-C-H	plasma CVD	NA	NA	NA	NA	stainless steel	NA	NA	
19	a-C-H	FAB -EBPVD	ɔol steel ASP23	0.5	0.015-0.017	640	st52100	NA	NA	
20	a-C-H	plating laser	stainless steel	2	0.17	500	corundum	NA	NA	
21	a-C-H	RF plasma	stainless steel	0.5-1	0.03	620	steel-alumina	0.02	NA	

Table 4.3 Tribology data sheet for coatings :Polymers and elastomers

	Film	Deposition r	Substrate	Thickness	Roughn R	hardness	Material cou	Roughn cour	hardness coı	حقل جديد
1	silicon rubber	ilicon adhesive	steel	300	0.25	NA	glass,silicon	NA	NA	
2	rubbery	NA	Glass	4	er -soft rubber	NA	glass	NA	NA	
3	pioyimide(pi)	raying+heating	ılless steel 440c	25	0.01-1.3	NA	ılless steel 440c	NA	NA	
4	polyimide (pi)	raying+heating	ılless steel 440c	25	0.9-1.2	NA	ılless steel 440c	NA	NA	
5	imide(pi-4701)	:aying +heating	ılless steel 440c	10-62	0.9-1.2	NA	ılless steel 440c	NA	NA	
6	yimide(PMDA)	:aying +heating	ılless steel 440c	25	NA	NA	ılless steel 440c	NA	NA	
7	PTFE	Rf sputtering	stainless steel	0.3	NA	Na	ılless steel 440c	NA	NA	
8	PTFE	sputtering	Glass	0.05-1	NA	NA	sapphire	NA	NA	
9	PTFE	spraying	Aluminium	30	NA	NA	aring,steel ball	NA	NA	
10	PTFE	NA	:rMoVa13 steel	15-22	NA	NA	100Cr6 steel	NA	NA	
0										

Table 4.4 Tribology data sheet for coatings: Diamond and diamond coatings

	Film	Deposition r	Substrate	Thickness	Roughn R	hardness	Material cou	Roughness c	hardness coi
1	PCD	high pressure	cemented WC	500	0.1-0.2	NA	:.4620,st.Nil2Cr	0.2-0.76	NA
2	TIB2	n implantation	NA	NA	NA	NA	diamond	NA	NA
3	DC	wave CVD	ɜ crystal silicon	1	0.001-0.35	NA	SCD	NA	NA
4	DC	HFCVD	SiC	2.5-4.3	NA	NA	SiC	NA	NA
5	DC	HFCVD	icon wafei,Mor	NA	pyramidal	NA	St52100	NA	NA
6	DC	wavCVD	Si,Mo	NA	0.047-0.094	NA	steel	NA	NA
7	DC	PACVD	SiC	1.5	0.1	NA	DC	0.1	NA
8	DC	t filament CVD	SiC	10	0.02	80	SiC	NA	NA
9	NA	Na	natural	NA	NA	NA	Diamond	NA	NA
10	NA	Na	diamond	NA	NA	NA	Si3N4	NA	NA
11	DC	wav CVD	natural	0.5-1.5	0.013	NA	diamond	NA	NA
12	DC	wav CVD	diamond	NA	NA	NA	si3N4	NA	NA
13	NA	NA	diamond	NA	NA	NA	diamond	NA	NA
14	DC	t filament CVD	WC-Co(KIO)	1	0.97	NA	DC	NA	NA
15	DC	hot flame CVD	ɪented carbide	1.5-5	0.53	NA	steel	NA	NA
16	NDC	hot flame CVD	ɪented carbide	NA	0.03	1360	stainless steel	NA	1360
17	DC	ve plasma CVD	silicon	NA	NA	NA	CVD diamond	NA	320
18	NA	NA	ɜtural diamond	NA	NA	NA	ɜtural diamond	Na	NA
19	DC	ve plasma CVD	Si3N4	3	0.155	NA	DC on Si3N4	0.155	NA

Table 4.5 Tribology data sheet for coatings :Molybdenum disulphide

	Film	Deposition r	Substrate	Thickness	Roughn R	hardness	Material cou	Roughn cour	hardness coi
1	MoSx	tron sputtering	steel (AISI420)	0.5-28	NA	NA	steel 100c6	NA	NA
2	Mos2	tron sputtering	in steel TI alloy	1	0.05	19.9	SiN	NA	NA
3	Mos2	ode sputtering	steel 440c	0.2-0.65	0.05	NA	steel 440c	NA	NA
4	Mos2	Sputtering	steel 52100	1	NA	NA	steel	NA	NA
5	Mosx	tron sputtering	steel (AISI)420	0.7-28	NA	NA	steel 100c6	NA	NA
6	Mosx	ode sputtering	steel 100r6	0.2-0.8	NA	NA	steel	NA	NA
7	Mos2	tron sputtering	alloy fiberglass	2.2	NA	NA	teel AISI 52100	NA	NA
8	Mos2	Rf sputtering	steel 440c	NA	NA	NA	steel 440c	NA	NA
9	Mos2	etron sputtring	steel AISI440c	0.1-5	0.07	NA	stel 52100	NA	NA
10	Mos2	ɪanical rubbing	steel 440c	1-2	0.09	NA	steel 440c	NA	NA
11	Mos2+add	sputtring	steel AISI D3	NA	NA	NA	steel	NA	NA
12	Mos2	f sputtering Dc	steel 440c	0.5-1	NA	NA	steel	NA	NA
13	Mos2	Rf sputtering	HPSiC steel	0.2	NA	NA	AL2O3	NA	NA
14	Mos2	sputtering	steel 440c	1	NA	NA	steel 52100	bearing grade	NA
15	os2-TiB2+Mos2	ɜam sputtering	steel 440c	NA	NA	NA	NA	NA	NA
16	Mosx	tron sputtering	steel 440c	0.11	0.009	6.8	steel 440c	0.007	8.5
17	Mosx	sputtering	steel 440c	0.11	0.016	6	steel 440c	0.008	8.5
18	Mos2	ɟ -Rf sputtering	steel 440c	1-5	0.15	58	Au,Ni,Mo	0.5	NA
19	Mos2	tron sputtering	teel AISI 52100	0.12	NA	NA	steel	NA	NA
20	TiN-Mos2	ɪ co-sputtering	stainless steel	0.5-3	NA	NA	steel	NA	NA
21	o-s amorphous	ɜposition (IBD)	steel	0.2-0.51	NA	NA	steel 52100	NA	NA
22	Mos1.3	tron sputtering	ɪless steel 440c	NA	0.05	NA	corundum	0.05	NA
23	Mos2-C-Tib2	tive sputtering	steel	NA	0.08	NA	steel 100cr6	NA	NA
24	Mos2-Ti	tron sputtering	1200 SiC steel	1.22	Na	NA	steel	NA	NA

Table 4.6 Tribology data sheet for coatings :Nitrides -)LTiN excluded

	Film	Deposition r	Substrate	Thickness	Roughn R	hardness	Material cou	Roughn cour	hardness coı	ة حقل جديد
1	(Ti,Al) N	Ion plating	steel ASP23	2-8	0.04	NA	Steel M50	NA	NA	
2	(Ti,Al)N	PVD	steel Hss	3.5	NA	NA	steel Cr5020	NA	NA	
3	CrN	Ion plating	steel	2-9	NA	NA	steel	NA	NA	
4	BN	beam dep,PVD	silicon	0.1	NA	NA	diamond	NA	NA	
5	BN	ɔeam dep .PVD	NA	NA	NA	NA	ainless steel 3(	NA	NA	
6	BN	tron sputtering	Wc-Co	1	NA	NA	diamond	NA	NA	
7	C-BN	ve evaporation	silicon	0.4	NA	NA	stainless steel	NA	NA	
8	Ti(B,N)	D rf magnetron	steel	5	0.04	NA	steel M50	NA	NA	
9	(Ti,Nb)N	PVD	steel	5.5	NA	NA	steel Cr5020	NA	NA	
10	(Ti,Al)N	.rc evaporation	steel	4	NA	NA	eel disk AISI 41	NA	NA	
11	(Ti,Al)N	Ion plating	steel	2-2.5	0.01	NA	corrundum	0.2	NA	
12	C-BN	Ion plating	silicon	NA	NA	NA	ss 440c	0.1	4.3	
13	TiAlN	PVD	steel 4140	4	0.4	1500	AISI 52100 stee	-	700	
14	CrN	acuum arc PVD	steel	2	0.05	2000	AL2O3	NA	NA	
15	VN	m evaporation	;h- speed steel	1.1	-	1100	steel	NA	NA	
0										
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Table 4.7 Tribology data sheet for coatings :Oxides and borides

	Film	Deposition r	Substrate	Thickness	Roughn R	hardness	Material cou	Roughness c	hardness coı	ة حقل جديد
1	Al2O3	CVD	ed carbide tool	NA	NA	0	steel 100Cr6	NA	Na	
2	Al2O3	tron sputtering	cast iron	4	0.36	300	steel	0.26	1000	
3	Ti-o	Ion plating	Hss ball	2	0.06	2000	steel ,copper	58	Na	
4	cdo	Sputtering CVD	steel	0.05-0.1	NA	NA	steel	NA	NA	
5	TiB2	CVD	Wc-Co	30-40	NA	NA	NA	NA	NA	
6	FexB	CVD	ted carbid tool	NA	NA	NA	steel Cr6 pin	NA	NA	
7	Fe2B	CVD	ed carbide tool	NA	NA	NA	Fe2B	NA	NA	
8	TiB2	mical tratment	Ti-6%v	30	2.8	NA	TiB2 coated	NA	NA	
0										

Table 4.8 Tribology data sheet for coatings :Soft metals

	Film	Deposition r	Substrate	Thickness	Roughness	hardness	Material	Roughness c	hardness co	حقل جديد
1	lead	NA	Copper	0.03-30	NA	NA	steel	NA	NA	
2	lead	sputtered	steel	0.1-0.2	0.05	NA	'b-coated steel	0.05	NA	
3	lead	brush plated	steel	NA	NA	NA	steel	NA	NA	
4	lead	ion plating	steel ball	0.01-10	0.75	NA	steel disk	NA	NA	
5	lead	ion plating	steel disk	0.1-10	0.025-0.7	NA	steel	NA	NA	
6	cadmium	NA	steel	1	0.4	1700	steel	NA	NA	
7	silver	ted deposition	Al2O3	0.5-2	0.3	NA	Al2O3	0.03	NA	
8	gold	electroplated	brass	1.5	NA	NA	gold coating	NA	NA	
9	indium	Na	tool steel	0.01-30	NA	NA	steel	NA	NA	
10	chrom	electroplated	steel	40	0.25	NA	steel	0.25	NA	
11	silver	IBAD	Si3N4	1	0.072	NA	Si3N4	NA	17.41	
12	silver	IBAD	ZrO2	2	0.2	NA	ZrO2	0.03	15	
13	silver	IBAD	Mgo-PSZ	1.5	0.2	0.25	Mgo-Psz	0.03	11	
14	silver	sputtered	AL2O3	1.5	0.1	NA	AL2O3	NA	20	
15	silver	ion plating	steel	1.5	0.75	NA	steel EN-31	NA	NA	
16	silver	PVD	IN coated steel	<5	NA	NA	steel	Na	NA	
17	with hardultra	ıal evaporation	ISI 52100 steel	2	0.02	57-61	AISI52100 steel	55-60	NA	
18	gold	sputtering	440c steel	0.26	0.03	NA	440c steel	NA	NA	
0										

Table 4.9 Tribology data sheet for coatings :Titanium nitride coatings

	Film	Deposition r	Substrate	Thickness	Roughness	hardness	Material cou	Roughness c	hardness co	حقل جديد
1	TiN	Ion plating	Steel	4	NA	NA	Mild steel	NA	NA	
2	TiN	Ion plating	HSS	1	0.06	NA	Tool steel	NA	NA	
3	TiN	ARE	Stainless steel	4-8	0.3	NA	Steel	0.1	NA	
4	TiN	CVD	Steel	3	0.9	NA	Steel	1.7	NA	
5	TiN	Reactive	Steel 304SS	NA	NA	NA	Steel 440CSS	NA	NA	
6	TiN	ring avaporatin	Steel 835M30	2	0.14-0.88	NA	Diamond	NA	NA	
7	TiN	Sputtering	Tool steel	0.1-2.7	0.28-0.9	NA	Steel	NA	NA	
8	TiN	PVD arc	Steel ring	10	0.1	NA	Steel AISI 01	0.25-0.3	NA	
9	TiN	PVD	Steel Inconel	25	NA	NA	arbon graphite	NA	NA	
10	TiN	PVD	Stainless steel	5	NA	NA	Steel	NA	NA	
11	TiN	CVD	Steel	NA	0.1	NA	Steel	NA	NA	
12	TiN	NA	NA	NA	NA	NA	TiN	NA	NA	
13	TiN	PVD	Steel	0.6-0.8	0.05-0.09	NA	Tool steel	0.05-0.09	NA	
14	TiN	Bias activated	Stainless steel/	4-6	NA	NA	Stainless	NA	NA	
15	TiN	CVD	3	3	NA	NA	TiN on	NA	NA	
16	TiN	Ion plating	HSS ASP23	1.5	0.24	NA	Chromium	0.02	63	
17	TiN	Reactive	Tool steel M2	0.2-5	0.06-0.1	NA	Steel 52100/	Steel	NA	
18	TiN	PVD	Stainless steel	3-5	0.35	NA	Stainless	0.35	Na	
19	TiN	Magnetron	M2 tool steel	5	0.26	33	Alumina	0.2	NA	
20	TiN	Electron beam	HSS ASP	Steel	0.015	2500	Steel AIAI	NA	NA	
21	TiN	Reactive	HSS	2	-	2000	Steel	NA	NA	
0										

By using last data-base tables one can search about any coating material easily and making any query then choose the suitable coating for the application required.

CONCLUSIONS

Importance of coating appears in reducing wear and corrosion of surfaces for different materials and metals using suitable coatings appropriate for the applications is very difficult to be applied, this data-base model offer an easy, quick, and flexible way to choose the suitable coating for the required application.

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