Title: D2-3 Formation of High Function Ceramic Surface by Ion Implantation(Discussions and Concluding Remarks, Session 2 : Surface Modification, SIMAP’88 Proceedings of International Symposium on Strategy of Innovation in Materials Processing—New Challenge for the 21st Century—)

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these new processes have their own merits and devererito compared with conventional other processings. Some
countermeasures must be necessary to improve their
potential.
My question is what should we do in order to improve these new technologies for applying to pratical use in
production. Please point out one or two important points
which we should consider and solve for improvement of
each process Dr. Wehr has classified.

Answer (Dr. M. Wehr) :
As far as I know, some of the processes I have described
are already in development, and will be on production line
(in less than 2 years) in a near future, but nor is the field
of ceramics coating (it means that there is no more
problems for certain of these processes, in some compa-
nies). It is the use of the stellite coating of turbine
blades by powder injection processes assisted by laser,
process which is already in development. It is also the
case of deposition of metal by laser CVD for mask
depositing, and this process is already sold on the market.

“Formation of High Function Ceramic Surface
by Ion Implantation”
Prof. N. Iwamoto

Question (Dr. Iwaki) :
I am much interested in your work, and I think you
suggest the possibility that a certain ceramics transforms
other types of ceramics by high fluence ion implantation.
I think that there are two big categories in the fields of
surface modification of ceramics by ion implantation; one
is the metallization of the near surface layers of ceramics
by metal ion implantation and the other is the transition
of types of ceramics by high fluence ion implantation
with light ions such as carbon, nitrogen and oxygen.
Your report is an example of the latter case, you in-
troduces preliminary experimental results with micro-
characteristics of nitrogen implanted SiC measured by
means of RBS, XPS, SIMS and laser Raman. It seems that
the results indicate the formation of nitrides, oxides,
oxynitrides, carbon nitrides, graphite and so on. We have
investigated the surface layer modification of non-oxide
ceramics such as AlN and SiC by metal ion implantation
with a high fluence. We also found such similar results as
the formation of graphite and oxides in SiC due to ion
implantation.
In order to clarify the formation of compounds in
nitrogen implanted SiC, I will ask you three questions.
1. It seems that the RBS spectra for nitrogen implanted
SiC, that is the as-implanted SiC, indicate the enrich-
ment of carbon near the surface layers. Is it true?
2. You explain that the XPS spectra for Sl2p indicate the
occurrence of oxidation. Please show us the ratio of
compositions for all of the elements in nitrogen im-
planted SiC and the XPS spectra for O1s.
Lastly, are your experimental results desirable from the
standpoint of improvement of physical, chemical and
mechanical properties?

Answer (Prof. N. Iwamoto) :
1. As shown in Fig. (7), we can conclude that the de-
composition of SiC, that is to say, to form free carbon
and silicon occurs with nitrogen ion implantation at
the surface of specimen. Also it is recognized that the
higher the ion implantation is, the greater free carbon
forms.
2. As shown in Figs 4(a), (b) and 5(a) and (b), it can be
seen the formation of SiO2 with after-heat-treatment
of 1273°C x 1 hr. (Si2p value=103.5eV)
In Fig. 4(a) and (b), the only formation of SiO2 with
the disappearance of SiN4 can be determined. Of
course, in Fig. 4(a) and (b), the relation between the
ratio of SiN4/SiO2 and the change of after-heat-
treatment temperature is given so that the former can be
calculated by using convolution method.
3. Though the author did not present in this publication
the improved behaviors of the mechanical properties
such as wear-resistance, hardness and fracture tough-
ness with ion implantation in SiC, this technique is
superior one for the improvement of physical, chemical
and mechanical properties of every matter.

Concluding Remarks
Prof. H.D. Steffens and Prof. N. Iwamoto

In session II, the progress on the surface modification
procedures have been treated.
At first, Professor Steffens of Dortmund University in
West Germany presented the paper titled “Arc and Plasma
Spraying Today and in the ’90th”. He emphasized that arc
and thermal spraying technologies were becoming
more and more important technique to give special
properties such as high resistance to corrosion and wear to
materials. The production of composite texture composed
from austenitic steel fiber embedded into MCrAlY alloy
phase with after-hot isostatic pressing was introduced.
Following, he said that the application of vacuum plasma
spraying for MCrAlY coating on turbine blade was im-
portant. However recent endeavours to apply this procedure
to coat reactive materials such as titanium and tantalum
have been paid. He presented new plasma spraying