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CONFIRMATION OF FAX

Dear Sirs

European Patent Application No. 03779387.4 (1560943)
Regional Phase of PCT Application PCT/US2003/034226
Zond, Inc.

In response to the Examination Report dated 10 October 2007, we enclose herewith amended pages 2, 2a, 2b and 30-32 to replace pages 2 and 30-32 currently on file. To aid the Examiner, we also enclose a draft copy of those pages in which the changes made to the text can be clearly seen.

The Examiner will note that a new independent apparatus claim 1 is provided, based on claim 1 of the application as filed and as published in the International phase. A new method claim 14 has also been included, which corresponds in scope to new claim 1 and is likewise based on claim 16 of the application as filed and as published in the International phase. Basis for claiming the application of a voltage pulse arranged to increase ionisation in the plasma to cause the thermal sputtering response of the target to become non-linear and increase significantly can be found in paragraphs [0140]-[0147] of the International application as filed and as published.

Dependent claims 3, 4, 7, 9 and 16 have been deleted and the remaining claims have been renumbered. New dependent claim 13 is based on claim 2 of the application as filed.

We note the Examiner's novelty objection and will now set out how new claims 1 and 14 are distinguished over D1.

New claims 1 and 14 are directed to a sputtering source and method that achieves a high deposition rate and in which an ionisation source produces a plasma close to a cathode assembly which includes the sputtering target and is positioned adjacent the anode. A power supply then applies a voltage pulse between the anode and cathode which has a rise time and amplitude to increase the degree of ionisation in the plasma so that, when the ions are impacted on the surface of the sputtering target, they heat the target to a temperature at which the sputtering yield has a non-linear response to temperature and the sputtering rate thereby increases significantly. The invention now claimed is illustrated in Figures 6 and 8-11 of the application.

D1 relates to a sputtering method and apparatus which is directed not to achieving a high deposition rate, but to achieving deposition of a conformal layer of a sputtering material on a substrate so as to avoid problems such as uneven deposition and faceting, as shown in Figures 1-4. To achieve this, a plasma gas is supplied to an evacuated chamber 100 through a gas inlet 136 whereby magnets 106 cause the plasma to collect adjacent a sputtering target 104 (see Figure 5, column 5 lines 38-46 and column 6 lines 47-52). The first signal generator 150 applies a bias voltage to the target 104 which attracts the plasma ions and which causes the target 104 to be sputtered. A bias voltage applied to the coil 122 by a third signal generator 132 increases the plasma density in the region of the coil which causes ionisation of the sputtered particles which are then attracted to the substrate 110 to be deposited thereon in a controlled manner by a bias voltage applied by a second signal generator 156 (see column 6 lines 55-65). Modulation of the bias voltage applied to the substrate 110 achieves uniform coverage of the substrate and a conformal sputtering layer (see column 7 lines 15-20).

Thus in D1 the bias voltage signal applied by first signal generator 150 to the sputtering target causes the sputtering target to act as a cathode assembly in the sense of new claims 1 and 14. D1 discloses only two modes of operation of the first signal generator during sputtering.

In the first method of D1, 'the waveform of the bias on the target 104... is held at a constant voltage throughout the process... Thus sputtering from the target is constantly maintained at a substantially constant rate' (see column 8 lines 32-36 and Figure 11). Thus, in this method of operation, no voltage pulse is applied to the cathode as required by new claims 1 and 14.

In the second method of D1, 'the power supplied to the target 104 is a pulsed signal...' (see column 9 line 58 to column 10 line 10) and is shown in Figure 15, which is a square wave pulse of constant amplitude. There is no disclosure in D1 of controlling the rise time or amplitude of the square wave pulses for any purpose. Thus, in this method of operation, again, no voltage pulse is applied to the cathode having a particular amplitude and rise time as required by new claims 1 and 14.

In D1, the only disclosure of a voltage signal having a variable waveform and amplitude is that which is applied to the sputtering substrate 110 by the second signal generator 156 to control the directionality and deposition profile achieved by the sputtering apparatus.

Thus there is no disclosure in D1 of applies a voltage pulse between the anode and cathode which has a rise time and amplitude to increase the degree of ionisation in the plasma so that, when the ions are impacted on the surface of the sputtering target, they heat the target to a temperature at which the sputtering yield has a non-linear response to temperature and the sputtering rate thereby increases significantly.

We therefore submit that new claims 1 and 14 are novel.

While there are no outstanding inventive step objections to the claims, we enclose the following comments to assist the Examiner.

There is no teaching or suggestion anywhere in D1 that would motivate the skilled man to think to adapt the apparatus and method taught in D1 to arrive at the invention now claimed.

Further, the inventive concept of modulating a voltage applied between the anode and cathode to harness the a non-linear thermal response of the sputtering yield and increase the deposition rate is nowhere suggested in D1 and so the skilled man would simply not think of it. Indeed, the physical principle of a non-linear thermal response is not even acknowledged in D1.

By using a sputtering target and method having a voltage pulse arranged arranging to have this non-linear sputtering yield response, the high deposition rate can be achieved on a substrate to be coated, which can be as great as one micron per minute (see paragraphs [0144]-[0147]). Further, the provision of a gas in a pre-existing plasma state before application of such a voltage pulse substantially eliminates the possibility of creating an unwanted electrical breakdown condition on the application of the pulse (see paragraph [0113]).

We therefore submit that claims 1 and 14 provide an inventive step.

The Examiner will note that a minor correction has been to claim 6 (previous claim 10) to recite that the strongly-ionised plasma is substantially uniform. Support for this correction can be found in see paragraph 82 of the application and in claim 14 of the International application as published.

We submit that the Examiner's clarity objections no longer apply as claim 1 now refers to apparatus features specifically arranged or configured to put the claimed invention into effect.

Further, it is would be entirely clear to the skilled man, not just in view of the description, that a reference to a 'weakly-ionised plasma' in the claims indicates a plasma having an ionisation level lower than that of a 'strongly-ionized plasma' and there can be no lack of clarity. In any case, the weakly- and strongly-ionized plasmas are now claimed to have a measurable functionally defined relationship, in that a weakly-ionized plasma is provided that is then further ionized to a higher degree of ionization to achieve a strongly ionized plasma that achieves a non-linear thermal sputtering response when it impacts the sputtering target that would not be achieved by the weakly-ionized plasma.

With regard to formal matters, the Examiner will note that: the description has been amended in accordance with the claims; an acknowledgement of the prior art has been inserted into the description; reference numbers have been inserted into the claims; and that claims 1 and 14 have been arranged in two-part form, characterised over D1.

We trust this application is now in order for grant. However, if there are any objections we request a further Examination Report or the opportunity to discuss the objections with the Examiner by telephone. If, despite this, the Examining Division is at any stage intending to refuse this application for any reason, we hereby request Oral Proceedings.

Form 1037 is enclosed for acknowledgment purposes.

Yours faithfully
Frank B. Dehn & Co.

Robert Jackson