In another example which involves the study of gas-surface interactions at different temperatures, micro-hotplates with a specific film coating can be heated to different temperatures, or subjected to different temperature cycling, and subjected to a gaseous environment of known pressure and composition. Conductance changes of the microfilms with gas exposure and temperature can provide a rapid picture of the nature of the chemical interactions occurring at the surface.

Although the present invention has been described with reference to particular means, materials and embodiments, from the foregoing description, one skilled in the art can easily ascertain the essential characteristics of the present invention and various changes and modifications may be made to adapt the various uses and characteristics without departing from the spirit and scope of the present invention as described by the claims which follow.

What is claimed is:

1. A method of preparing a plurality of micro-samples of materials for investigation which comprises:

providing a substrate having a plurality of micro-hotplates, wherein each of said plurality of micro-hotplates can be individually temperature controlled; and

depositing a material film on said plurality of micro-hotplates while thermally cycling selected ones of said plurality of micro-hotplates to form a micro-sample on each of said plurality of micro-hotplates.

2. A method of preparing a plurality of micro-samples of materials for investigation according to claim **1**, wherein said step of thermally cycling selected ones of said micro-hotplates comprises heating all of said plurality of micro-hotplates to a common temperature.

3. A method of preparing a plurality of micro-samples of materials for investigation according to claim **1**, wherein selected ones of said micro-samples are subjected to a post-deposition annealing treatment by heating selected ones of said micro-hotplates after said deposition step.

4. A method of preparing a plurality of micro-samples of materials for investigation according to claim **2**, wherein selected ones of said micro-samples are subjected to a post-deposition annealing treatment by heating selected ones of said micro-hotplates after said deposition step.

5. A method of preparing a plurality of micro-samples of materials for investigation according to claim **1**, further comprising performing a lithography process for isolating selected ones of said micro-hotplates prior to said deposition step.

6. A method of preparing a plurality of micro-samples of materials for investigation according to claim **5**, wherein said lithography process involves applying a resist material to said substrate, irradiating portions of said resist material utilizing a mask and removing said irradiated portions of said resist material.

7. A method of preparing a plurality of micro-samples of materials for investigation according to claim **5**, wherein said lithography process comprises a maskless-lithography process.

8. A method of preparing a plurality of micro-samples of materials for investigation according to claim **7**, wherein said maskless-lithography process involves applying a resist material to said substrate and heating selected ones of said plurality of micro-hotplates to volatilize and thereby remove portions of said resist material.

9. A method of preparing a plurality of micro-samples of materials for investigation according to claim **1**, wherein said step of depositing involves a sputtering process.

10. A method of preparing a plurality of micro-samples of materials for investigation according to claim **1**, wherein said step of depositing involves a chemical vapor deposition process.

11. A method of preparing a plurality of micro-samples of materials for investigation according to claim **1**, wherein said step of depositing involves an evaporation process.

12. A method of preparing a plurality of micro-samples of materials for investigation according to claim **1**, wherein electrical properties of said material film are measured during said deposition.

13. A method of preparing a plurality of micro-samples of materials for investigation according to claim **3**, wherein electrical properties of said material film are measured during said annealing.

14. A method of preparing a plurality of micro-samples of materials for investigation according to claim **4**, wherein electrical properties of said material film are measured during said annealing.

15. A method of characterizing material properties which comprises:

providing a substrate having a plurality of micro-hotplates, wherein each of said plurality of micro-hotplates can be individually temperature controlled;

depositing a material film on said plurality of micro-hotplates while thermally cycling selected ones of said plurality of micro-hotplates to form a micro-sample on each of said plurality of micro-hotplates; and

characterizing properties of said micro-samples.

16. A method of characterizing material properties according to claim **15**, wherein said properties of said micro-samples which are characterized are selected from the group consisting of electrical properties, chemical properties, physical properties and combinations thereof.

17. A method of characterizing material properties according to claim **15**, wherein said characterization is performed during said deposition step.

18. A method of characterizing material properties according to claim **15**, wherein said characterization is performed by scanning electron microscopy, scanning tunneling microscopy, atomic force microscopy or x-ray analysis.

19. A method of characterizing material properties according to claim **15**, wherein selected ones of said micro-samples are subjected to a post-deposition annealing treatment by heating selected ones of said micro-hotplates after said deposition step.

20. A method of characterizing material properties according to claim **15**, wherein said step of thermally cycling selected ones of said micro-hotplates comprises heating all of said plurality of micro-hotplates to a common temperature.

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