1. Company profile

JENION - Dr. Hermann Schlemm - Ion Beam- and Surface-Technique was founded in 1994. It is a small company for special problems of Ion Beam- and Thin Film Technology. These are:

- Specialized Broad Ion Beam Systems for Research & Development and industrial applications like mass separated Ion Sources, Broad Beam Ion Implanters and reactive gas ion sources
- Cold Cathode Plasma and Ion Sources working by the ACC-principle,
- Plasma and Ion Beam Measuring Technique,
- Research & Development in the field of Ion Beam- and Plasma-Technology,
- Research & Development in the field of Thin Film Technology.

2. Products overview

Fig.1 and tab.1 give an overview about the ion beam parameters of our systems. Some more customer specified solutions are possible.
Overview:
Ion Beam Processes for Thin Film Technologies

**IBAD:**
Ion Beam Assisted Deposition
- Substrate
- Thin Film
- Evaporated Neutrals
- Electron Beam Evaporator
- Noble Gases: O₂, N₂, H₂, CH₄,...

**DIBS:**
Direct Ion Beam Sputtering
- Substrate
- Thin film
- Sputtered Neutrals
- Target
- Ion Beam (600-1000 eV)
- Ar, Xe

**Ion Implantation**
- Substrate
- Implanted Region (at 5-500 nm depth)
- Ion Beam (5 – 100 keV)
- Ion Source
- Noble Gases: O₂, N₂, H₂, molecular precursors

**DIBD:**
Direct Ion Beam Deposition
- Substrate
- Thin Film
- Ion Beam with depositing Ions (50-1000eV)
- Ion Source
- Low temperature melting metals (Zn, Pb, Se, P)

**RIBE:**
Reactive Ion Beam Etching
- Etched Film
- Ion Beam with etching Ions (50-1000eV)
- Ion Source
- Etching Precursors (CF₄, SF₆,...)

**CAIBE:**
Chemical Assisted Ion Beam Etching
- Etched Film
- Etching Precursor (from gas shower)
- Ion Source
- Noble Gas
<table>
<thead>
<tr>
<th>Ion source type</th>
<th>Ion energy</th>
<th>Ion beam dimensions</th>
<th>Ion source type</th>
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<tbody>
<tr>
<td>K 40 MIS</td>
<td>20 - 1000 eV</td>
<td>40 mm diameter</td>
<td>mass separated filament ion source</td>
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<tr>
<td>ACC 40 IS</td>
<td>20 - 1000 eV</td>
<td>40 mm diameter</td>
<td>alternating cold cathode ion source</td>
</tr>
<tr>
<td>ACC 30 x 150 IS, ACC 40 x 300 IS, ACC 40 x 600 IS</td>
<td>20 – 1000 eV</td>
<td>30 x 150 mm, 40 x 300 mm, 40 x 600 mm</td>
<td>Linear alternating cold cathode ion sources</td>
</tr>
<tr>
<td>ACC 30 x nnn IMP</td>
<td>1 – 60 keV</td>
<td>nnn mm ion beam</td>
<td>Broad ion beam implanters with linear ACC ion sources</td>
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<tr>
<td>ACC 80 PS</td>
<td>10 – 150 eV</td>
<td>80 mm plasma stream diameter</td>
<td>alternating cold cathode plasma source</td>
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</table>

Tab. 1: Overview JENION ion beam systems

3. History

- 1994:
  JENION was founded, first tests of mass separating ion filters and hot cathode ion sources.

- 1995-1996:
  Building up of our ion-beam-laboratory at Schorba near Jena, publication of the principle of the broad beam ion mass filter [1], development of the mass separating system, first broad ion beam implantation experiments [2].

- 1997-1998:
  Start of the production of the mass separating broad ion beam systems, several publications on applications of these systems in ion implantation and surface modification [3,4].

- 1999-2001:
  Development of the Alternating Cold Cathode principle leading to reactive gas stable plasma sources [5], production of first ACC- ion- and plasma sources (ACC-40 IS).

- 2000 – 2001:
  Development of the alternating cold cathode plasma source ACC-80 PS as a low energy ion source.

- 2001 – 2003:
  Development of multiple plasma probe analyzer for measuring plasma parameters and plasma an ion beam profiles (“Plasma Mon”).
  Development of the ACC ion source for low temperature melting metals for low energy metal ion implantation,
  First production and development of inline stepper motor driven substrate holders for plasma- and ion beam processing.

- 2003:
  Production of the first broad beam ion implanter with a linear ACC ion source, (together with DMS-Dresden GmbH),
  Development of linear ACC ion- and plasma sources with ion beam length from 150 to 600 mm,
  development of halogen lamp heaters for plasma- and ion beam processes.
3. Recent projects and developments

- Ion beam impurity analysis of mass filtered broad ion beams (project with Institut for Surface Modification, Leipzig, www.iom.uni-leipzig.de [9], 1998).
- Reactive ion beam etching (RIBE) of quartz glass with ACC-ion sources, max. etch rate 1µm/min, (contribution to projects at Institut for Surface Modification, Leipzig, 1999).
- Development of microstructured and other electrode systems for plasma generation at high pressure up to atmospheric pressure (contribution to a bmbf-project of Roth&Rau AG, Hohenstein-Ernstthal, www.roth-rau.de [6,7], 1999 – 2001).

4. Future projects

- Complete solutions for plasma- and ion beam processing with linear sources.
- High pressure plasma sources.
- Retarding field analyzers for electron- and ion energy distribution analysis at plasmas.
- Broad ion beam implanters and technology.

6. References