



# **Joint Development Agreement**

**Microchemistry Ltd.**

**Chung Song System Co., Ltd.**

**Samsung Electronics Co., Ltd.**

**September 8, 1997**

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## Joint Development Agreement

This Agreement is made among Microchemistry Ltd., a company organized and existing under the laws of Finland, having its principal place of business at Keilaranta 6, P.O.Box 45, FIN-02151 Espoo, Finland (hereinafter referred to as "MC"), Chung Song System Co., Ltd., a company organized and existing under the laws of the Republic of Korea, having its principal place of business at 438-1, Mogok-dong, Pyungtaek-city, Kyungki-do, Korea (hereinafter referred to as "CS") and Samsung Electronics Co., Ltd., a Korean corporation organized and existing under the laws of the Republic of Korea, having its principal place of business at 250, 2-ka, Taepyung-ro, Chung-ku, Seoul, Korea ("SEC").

### Recitals

WHEREAS, MC produces proprietary machinery, the ALE(Atomic Layer Epitaxy)-reactor, for performing ALE process and possesses valuable technical information and know-how on ALE process;

WHEREAS, CS produces semiconductor system including CVD(Chemical Vapor Deposition) equipment;

WHEREAS, SEC is interested in ALE technology and desires to develop ALE-based system for the synthesis of oxide films to manufacture semiconductor devices;

WHEREAS, MC and CS intend to cooperate to manufacture and sell semiconductor production line systems based on the concepts developed under this agreement;

WHEREAS, MC, CS and SEC ("parties") desire to start joint development of ALE-based system; and

WHEREAS, the parties intend to make a separate agreement with the fourth party who manufactures and sells semiconductor system which is used in semiconductor production line.

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NOW, THEREFORE, in consideration of promises and covenants hereinafter set forth, the parties hereto agree as follows:

### Article 1. Structure of Cooperation

1.1 MC, CS and SEC shall study the general applicability of ALE-derived films and select and evaluate jointly one or more promising ALE films to be used in SEC's semiconductor line within six (6) months from the arrival of modified F-450 system at Kiheung according to the schedule defined in Exhibit A.

1.2 The parties acknowledge that parties or SEC may decide to work together with the fourth party who has a good financial basis and excellent system expertise. Then, parties shall select and make an agreement with the fourth semiconductor equipment manufacturer who will provide an ALE-based system which includes one or several ALE-reactors. Such a selection of the fourth system manufacturer shall be made by consent of MC, CS and SEC.

1.3 An actual development of a semiconductor system to be used for semiconductor devices production shall begin with the first ALE film selected to be applied in SEC production based on the results in Article 1.1 before the next ALE film is decided.

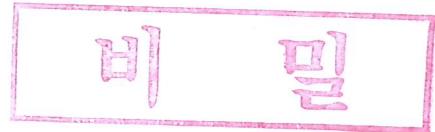
1.4 During the joint development of a semiconductor system, MC and CS and/or the fourth equipment manufacturer designated by Article 1.2 shall deliver alpha-site ALE-based system to SEC for the purpose of equipment evaluation. MC, CS, SEC and/or the fourth equipment manufacturer shall develop jointly ALE-based system which is based on SEC's evaluation results and requirements

1.5 MC and CS shall refrain from any technical information exchange with third party customers with respect to films selected to be applied in SEC production until processes for said films are implemented in SEC's production unless separately approved by SEC during the term of this Agreement. This will not, however, restrain MC from delivering ALE reactor to third party customers for producing any ALE films based on public knowledge or the customers' own proprietary know-how.

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## Article 2. Responsibility

2.1 During the term of this Agreement, MC shall be responsible for the followings:

- i ) deliver a modified F-450 with a manual load lock system to Kiheung, SEC's R&D Center by Carnet method before October 31, 1997
- ii) support and develop ALE processes of oxides such as Al<sub>2</sub>O<sub>3</sub>, Ta<sub>2</sub>O<sub>3</sub>, Nb<sub>2</sub>O<sub>5</sub>, ZrO<sub>2</sub>, and high dielectric films
- iii) train SEC's engineers to operate ALE system delivered and to do the maintenance
- iv) provide SEC with information on the operation of the ALE system and the recipe and properties of these films
- v ) provide SEC with information required for the best evaluation
- vi) manufacture and deliver to SEC, on alpha-site basis, a stand-alone ALE system jointly with CS
- vii) allow the fourth party to manufacture ALE system used in mass production line upon SEC's request

2.2 During the term of this Agreement, CS shall be responsible for the followings:

- i ) support MC's manufacture of modified F-450 by offering automated system-related know-how
- ii) manufacture and deliver to SEC, on alpha-site basis, a stand-alone ALE system jointly with MC
- iii) implement machine maintenance and retrofit as requested from SEC
- iv) allow the fourth party to manufacture ALE system used in mass production line upon SEC's request

2.3 During the term of this Agreement, SEC shall be responsible for the followings:

- i ) provide facilities, personnel and chemicals to run the ALE reactor delivered by MC
- ii) implement evaluation and/or testing with the ALE reactor
- iii) inform MC and CS of such evaluation results
- iv) decide the specific process to apply the ALE films
- v ) dispatch engineer(s) if necessary

2.4 Any costs which may arise by performing the responsibilities defined above shall be borne by the party incurring such costs.

2.5 MC, CS and SEC shall make best efforts to achieve the goal of this Agreement and

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discuss and assign, if needed, additional responsibilities.

### Article 3. Steering Committee

3.1 MC, CS and SEC shall nominate each representative and form a Steering Committee as set forth in Exhibit C. The role of the committee is to monitor the joint evaluation and development, fix a pending issue and support engineering activities so that the parties can fully implement their responsibilities. The Committee shall hold a meeting three times a year during the term of this Agreement.

3.2 SEC shall present output documentation two weeks prior to each meeting. The meeting shall be held three times or less a year as defined in Exhibit C.

### Article 4. Intellectual Property Rights

4.1 In the event that any intellectual property rights(IPRs) are created during the term of this Agreement, all IPRs related to semiconductor devices shall be owned by SEC and all IPRs related to semiconductor system shall be owned by MC and CS (system manufacturers) according to their mutual agreement. MC has a right to free use of IPRs related to ALE-process of specific materials in applications other than those used by SEC.

4.2 MC and CS shall share the IPRs related to manufacturing equipment and the system under a separate agreement between the parties.

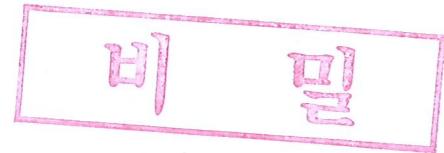
### Article 5. Confidentiality

5.1 During the term of this Agreement and for a period of three (3) years thereafter, the parties agree that all data, materials, and know-how which are proprietary and trade secret information provided hereunder ("Confidential Information") shall be regarded and treated by the parties in strictest confidence and shall not be disclosed to any third party without the express written consent of the disclosing party.

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5.2 The parties confirm that Confidential Information shall not be used for any other purposes except for implementing this Agreement.

- 5.3 The parties shall have no obligation on confidentiality for information which:
- i ) was in the public domain at the time of disclosure or thereafter becomes part of the public domain other than by breach of the receiving party;
  - ii) was in the possession of or already known to the receiving party at the time of disclosure;
  - iii) is publicly released by the disclosing party;
  - iv) is disclosed to the receiving party by third parties having no obligation to the disclosing party to keep the Confidential Information confidential;
  - v ) is independently derived or developed by the receiving party; or
  - vi) is required to be disclosed by law or government requirement.

5.4 IF A PARTY BREACHES ANY OF ITS OBLIGATIONS WITH RESPECT TO THE CONFIDENTIALITY AND UNAUTHORIZED USE OF CONFIDENTIAL INFORMATION HEREUNDER, THE REMAINING PARTY(OR PARTIES) SHALL BE ENTITLED TO EQUITABLE RELIEF TO PROTECT ITS (OR THEIR) INTEREST(S) THEREIN, INCLUDING BUT NOT LIMITED TO INJUNCTIVE RELIEF, AS WELL AS MONETARY DAMAGES.

#### Article 6. System Procurement

Upon the successful completion of this Agreement, in the event that SEC purchases ALE-based system from MC, CS or the fourth party, SEC shall be given by the most favored conditions in terms of price, delivery, etc. in consideration of the contributions compiled then currently. The detailed terms and conditions shall be negotiated in a separate agreement.

#### Article 7. Term and Termination

7.1 The term of this Agreement shall be three (3) years from the last signing date unless extended by the consent of the parties.

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7.2 A party may terminate this Agreement if

- i ) another party becomes insolvent or the subject of a voluntary or involuntary petition in bankruptcy; or
- ii) another party defaults in the performance of any material obligations hereunder and does not correct such default within sixty (60) days after the written notice.

7.3 In the event that this Agreement is terminated as specified in Article 7.2, within fourteen (14) days following a request by the disclosing party, the receiving party shall return any Confidential Information and the copies thereof to the disclosing party and not use Confidential Information any more.

7.4 After this Agreement is expired, in the event that MC, CS and/or the fourth party wants to use SEC's Confidential Information for the development of other system which is not subject to this joint development, the system company shall negotiate another agreement with SEC.

## Article 8. General Terms and Conditions

8.1 Notices All notices and requests required or authorized hereunder, shall be given in writing by registered or certified mail, postage prepaid, addressed as follows unless one party notifies the other in writing of any changes in such address:

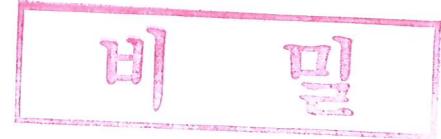
If to MC: ATTN: Dr. Tuomo Suntola  
Microchemistry Ltd.  
Keilaranta 6, P.O.Box 45  
FIN-02151 Espoo, Finland  
Tel) 358-204-50-5707  
Fax) 358-204-50-5700

If to CS: ATTN: Mr. S.K.Suh  
Chung Song System Co., Ltd.  
438-1, Mogok-dong, Pyungtaek-city,  
Kyungki-do, Korea  
Tel) 82-333-667-5171  
Fax) 82-333-667-4200

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If to SEC: ATTN: Dr. M.Y.Lee

Samsung Electronics Co., Ltd.  
San #24 Nongseo-ri, Kiheung-eup  
Youngin-city, Kyungki-do, KOREA  
Tel) 82-2-760-6012  
Fax) 82-2-760-6299

**8.2 Governing Law** The formation, validity, construction and performance of this Agreement shall be governed by and interpreted in accordance with the laws of the Republic of Korea.

**8.3 Arbitration** All disputes, controversies or differences which may arise between the parties, out of, or in relation to, or in connection with this Agreement, or for the breach thereof, shall be finally settled by arbitration in respondent's place in accordance with the International Chamber of Commerce rules. The award rendered by the arbitrators shall be final and binding upon parties concerned.

**8.4 Assignment** Neither this Agreement nor any right or obligation hereunder may be assigned to any third party by a party hereto, nor shall the same inure to the benefit of any trustee in bankruptcy, receiver or other successor of a party, without the prior written consent of another parties.

**8.5 Entire Agreement** This Agreement sets forth the entire agreement and understanding between the parties as to the subject matter hereto and supersedes all prior agreement, negotiations or understandings with respect thereto. This Agreement may not be changed, altered or amended in any manner, orally or otherwise, except in writing signed by duly authorized officers or representatives of parties hereto.

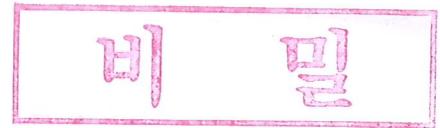
**8.6 No Waiver** The delay or failure of a party to exercise any right or option hereunder or failure to enforce any provision herein shall not impair any such right or option nor shall it constitute a waiver thereof or acquiescence thereto unless explicit written notice is provided.

**8.7 Severability** In the event that one or more provisions of this Agreement is or becomes or is deemed invalid, illegal or unenforceable in any respect, such invalidity,

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illegality or unenforceability shall not affect any other provision of this Agreement, and this Agreement shall be construed as if such invalid, illegal or unenforceable provision(s) had not been contained herein.

8.8 Publicity All publicity regarding the announcement of this Agreement shall be coordinated by all of MC, CS and SEC. Neither party shall disclose the terms and conditions of this Agreement without the prior written approval of another parties.

8.9 Headings The section headings appearing in this Agreement are inserted only as matter of convenience and in no way define, limit, construe or describe the scope or intent of such section, or affect this Agreement.

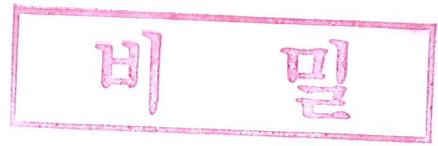
8.10 Independent contractor The parties are independent contractors. Nothing contained herein or done pursuant to this Agreement shall constitute the parties as entering into a joint venture or partnership, or shall constitute either party as the agent of the other party for any purpose or in any sense whatsoever.

8.11 Survival Notwithstanding the expiration or termination of this Agreement, Articles 4 and 5 shall survive thereafter.

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IN WITNESS WHEREOF, the parties have caused this Agreement to be executed in duplicate by their duly authorized representatives:

Microchemistry Ltd.

By: *Tuomo Suntola*

Name in full: Tuomo Suntola

Title: President

Date: 8.9.1997

Chung Song System Co., Ltd.

By: *Sung-ki Suh*

Name in full: Sung-ki Suh

Title: President

Date: Sep 8. 1997

Samsung Electronics Co., Ltd.

By: *Moon-yong Lee*

Name in full: Moon-yong Lee

Title: Vice President

Date: 08/09/97

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EXHIBIT A-1.

## 1. TARGET SCHEDULE

### Phase I : September, 1997 -December, 1998

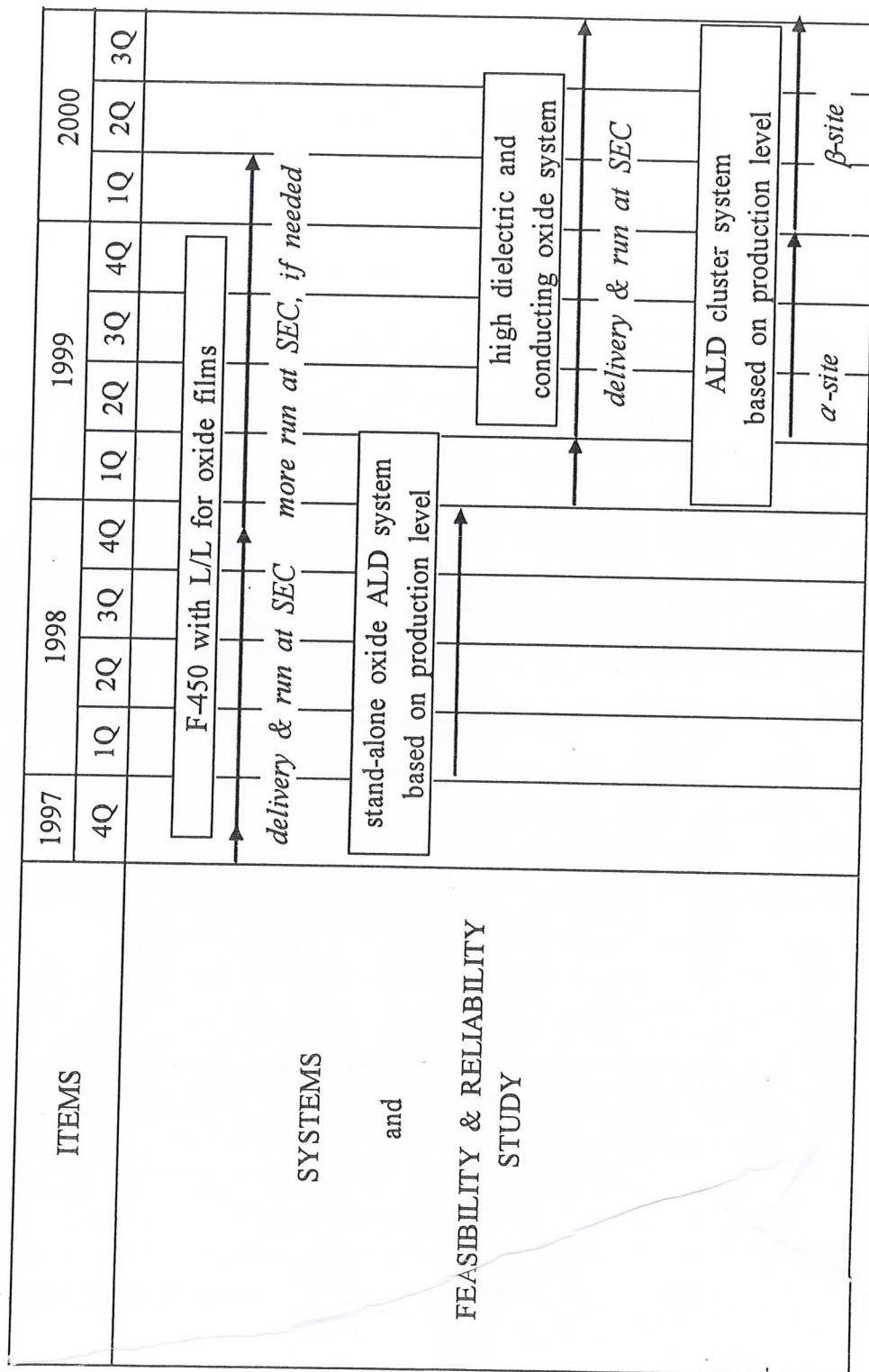
- Install F-450 with L/L for oxide films at SEC (Sept. - Oct., 1997)
- Feasibility study for the device applications by SEC (Nov., 1997 -Oct., 1998)
- Develop stand-alone type oxide ALD systems based on the mass-production by CS & MC (Jan. - Dec., 1998)
- Develop the ALD Process for high dielectric and conducting oxide films by MC (Sept., 1997 -Dec., 1998)

### Phase II : January, 1999 - August, 2000

- Install ALD system for the growth of high dielectric and conducting oxide films at SEC (Jan. - March, 1999)
- Feasibility study of high dielectric and conducting oxide films by SEC (Apr., 1999 - Aug., 2000)
- Develop cluster-type ALD systems based on the mass-production (Apr., 1999 - Aug., 2000)

EXHIBIT A-2.

2. KEY MILESTONES



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## 1. GENERAL ALD PROCESS AND HARDWARE CHARACTERISTICS

ITEM	GOAL
STEP COVERAGE	$\geq 95\%$
THICKNESS UNIFORMITY* (8 inch)	
+ within a wafer	$\leq 3\%$
+ wafer to wafer	$\leq 3\%$
+ lot to lot	$\leq 3\%$
COMPOSITION UNIFORMITY	$\leq 1\%$
COMPOSITIONAL DEPTH PROFILE	NO CHANGE
THICKNESS CONTROLABILITY	$\geq 99\%$
THROUGHPUT (run time & maintenance)	10 wafers / hour per module
PINHOLE	NO
PARTICULATE ( $\geq 0.16\mu\text{m}$ )	$\leq 20$ ea / 8 inch wafer

\*  $(\text{maximum} - \text{minimum})/2\text{average}$

## 2. GENERAL CHARACTERISTICS OF PROPOSED OXIDE MATERIALS

ITEM	GOAL					
MATERIALS	$\text{Al}_2\text{O}_3$	$\text{Ta}_2\text{O}_5$	$\text{Nb}_2\text{O}_5$	$\text{ZrO}_2$	HIGH DIELECTRICS	CONDUCTING OXIDES
PROCESS TEMPERATURE (°C)	$\leq 400$	$\leq 325$	$\leq 325$	$\leq 325$	$\leq 400$	$\leq 400$
REFRACTIVE INDEX @ 633 nm	$\geq 1.65$	$\geq 2.24$	$\geq 2.40$	$\geq 2.15$	-	-
STOICHIOMETRY (%)	$\geq 99\%$					
IMPURITY CONTENT	$\leq 1\%$					

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EXHIBIT C.

## STEERING COMMITTEE

### 1. Members

**SEC:** Moon-yong Lee  
Sang-in Lee  
Chang-soo Park  
Yeong-kwan Kim  
Sang-min Lee

**MC:** Tuomo Suntola  
Pekka T.Soininen  
Jarmo Skarp

**CS:** Sung-ki Suh  
Jang-ho Bae  
Chang-keun Lee  
Won-sung Choi

### 2. Meeting schedule

December 1997 at SEC  
April 1998 at MC  
August 1998 at CS  
December 1998 at SEC