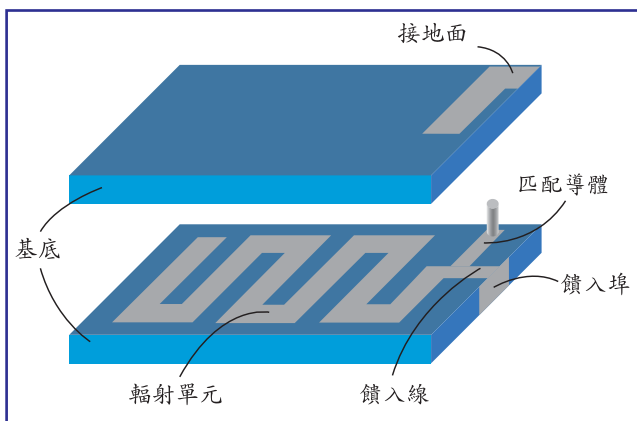


## 通訊產業

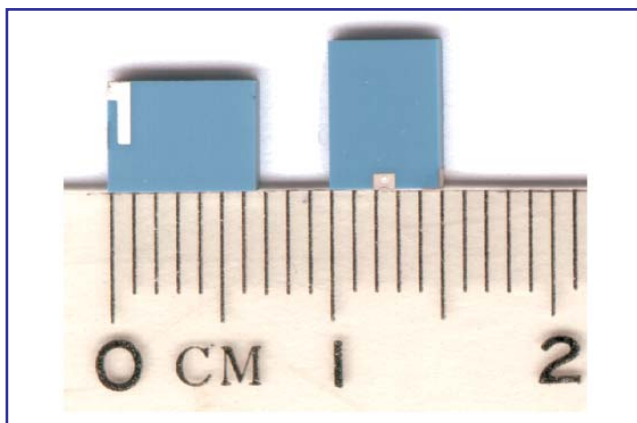
### 晶片型天線

在無線通訊系統中，天線是一個負責訊號傳送與接收的重要元件。為了滿足未來無線通訊產品輕薄短小的需求，晶片型天線便被發展來取代傳統式的線形（或螺旋形）天線。然而，在晶片型天線的設計上，要同時達到尺寸小與頻寬大的要求卻是一件相當困難的工作。有鑑於此，本發明提出了具有尺寸更小、頻寬更大的晶片型天線架構（見圖一）。

本發明之晶片型天線以單層或多層電介質材料作為基底，基底表面置有一饋入埠以提供訊號的饋入。其中，將一特殊曲折形狀的金屬導體放置於基底內作為輻射單元；並將另一金屬導體置於基底作為天線的饋入線，其一端與饋入埠相連以傳導訊號。此外，在饋入線與輻射單元之間有一匹配單元，當中包含匹配導體及接地面，匹配導體被至少一片的接地面所遮蔽。該匹配單元的功能則是用來改善天線的輸入阻抗以增加晶片型天線的頻寬。圖二所示為一操作在2.4GHz頻帶（工業、科學、醫學用頻帶）的晶片型天線實體。



圖一 晶片型天線結構示意圖



圖二 操作於2.4GHz頻帶的晶片型天線實體圖

本發明之晶片型天線的特點包含尺寸小、頻寬大、電氣特性穩定等等，

### 本期內容

- 晶片型天線
- 可耐高溫操作之高崩潰電壓異質結構場效電晶體
- 以簡易製程製作GHz級低損失頻寬甚大的新型表面聲波濾波器
- 對腦癌具有特殊活性之嘧啶類葉酸代謝拮抗劑
- 新穎螢光生物晶片(Phosphor-Biochip)

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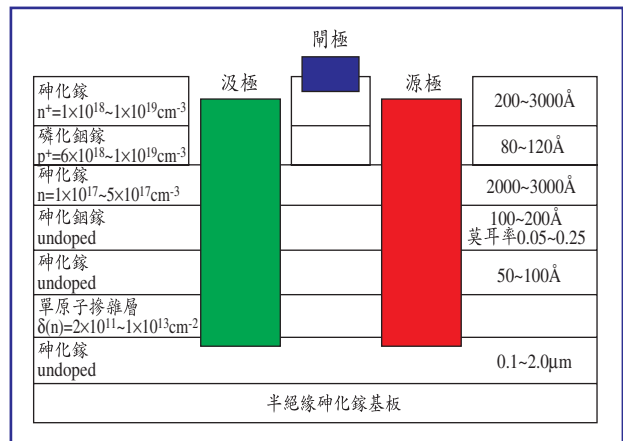
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非常適合應用於短距離無線通訊產品上（如藍芽模組、無線區域網路）。

本發明已獲中華民國專利(公告號452996)，歡迎對此技術有興趣的廠商與我們聯繫。

聯絡人：曾文仁、沈志文、陳建宏、徐肇徵，工業技術研究院電腦與通訊工業研究所，(310)新竹縣竹東鎮中興路4段195號14館，電話：(03)5732124、(03)5917613。



圖一 元件之結構剖面圖

### 積體電路產業

#### 可耐高溫操作之高崩潰電壓異質結構場效電晶體

近年來以化合物半導體製作的高速、微波及功率等零組件，在電子IC之領域中，一直是相當熱門且扮演關鍵性的角色。許多須長期處於高溫環境下的場效電晶體元件(FET)已廣泛地應用在如外太空勘查、衛星科技、自動控制系統、導航、雷達、及地底探測等高科技設備中。然而，隨著元件尺寸一再的縮小，電極與電極之間的距離不斷的接近，FET中之閘-汲極間的高電場將容易造成元件崩潰。當FET工作在高溫環境時，元件隨著外在環境溫度的上升，其閘極位障會隨之降低，而使閘極漏電流增加而影響元件特性；同時亦有基板漏電流產生，使元件的崩潰電壓降低及高溫特性劣化。

本發明提出一種可耐高溫之高崩潰電壓異質結構場效電晶體，其閘極為 $n^+$ -砷化鎢/ $p^+$ -磷化鎢/ $n^-$ -砷化鎢異質接面之高障壁的結構，由於在磷化鎢/砷化鎢異質接面間具有相當的導電帶及價電帶不連續度存在，可有效地侷限電子於通道層內，以得到一高傳導值、低漏電流、高崩潰電壓的良好元件特性。而副通道層為一砷化鎢磊晶層設計，由於砷化鎢/砷化鎢/砷化鎢之異質接面，其傳導能帶形成一量子井通道之結構，可加強侷限電子的能力及元件線性度。此外，使用反向單原子摻雜層作為副通道電子提供層，可提高電子濃度、電子移動率及降低雜質散射等現象。當此發明結構應用在元件製程時，不但可改善元件之一般特性，並可維持元件良好的高溫特性。

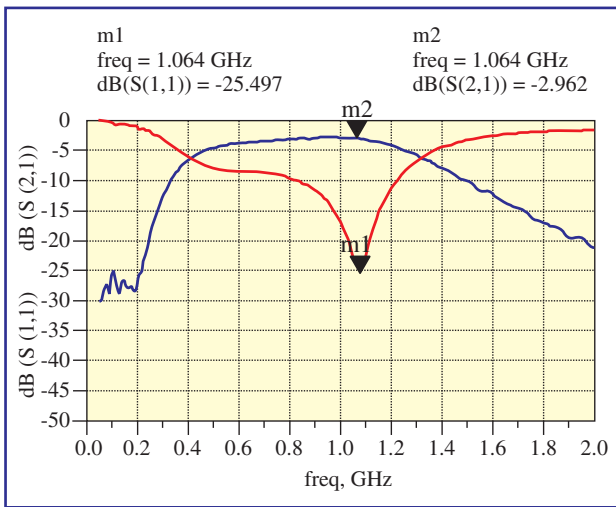
本發明已獲中華民國發明專利(公告號452978)，希望尋求國內外半導體、光電廠商合作製造。

聯絡人：劉文超、蔡榮輝、常文龍、余國輝、林坤緯，國立成功大學電機工程系與微電子工程研究所，(701)台南市大學路一號，電話：(06)2757575 轉62354。

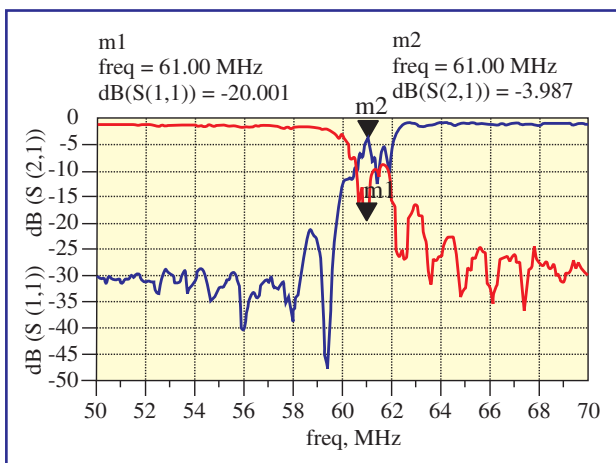
### 電子產業

#### 以簡易製程製作GHz級低損失頻寬甚大的新型表面聲波濾波器

本發明技術係應用表面聲波相關的理論基礎，再經由適當地交錯耦合組合的電路設計，而得到一中心頻率在GHz範圍、低插入損失( $S_{21} = -2.962 \text{ dB}$ )、頻寬( $BW = 80\%$ )甚大的新型表面聲波濾波器。此一特性乃因訊號波動之交互作用，使得表面聲波濾波器的中心頻率、頻寬得以因參數效應而大幅提升，同時降低插入損失，此技術若應用在高頻操作時能提供較典型表面聲波元件更優異的濾波功能和寬廣的操作頻寬。利用此技術無需縮小交叉指狀兩電極間的距離至 $1 \mu\text{m}$ 以下，即可有效地提高中心頻率至GHz級以上。圖一為此新型電路(內含42對 $16 \mu\text{m}$  IDT)製作於 $128^\circ$  rotated YX-LiNbO<sub>3</sub>基板之頻率響應特性。圖



圖一 新型電路(內含42對16 μm IDT)製作於LiNbO<sub>3</sub>基板之頻率響應特性



圖二 新型電路(42對16 μm IDT)於LiNbO<sub>3</sub>基板製作成傳統表面聲波濾波器之頻率響應特性

二為此新型電路(42對16 μm IDT)亦可製成傳統表面聲波濾波器之頻率響應特性。

本發明之主要優點：(1)只需要一次光罩對準，製程簡單，非常適合於大量生產。(2)此新型濾波器因係利用參數效應製造，故可改善傳統表面聲波元件缺點並有效減少插入損失至3 dB以內。(3)有效地提高中心頻率至GHz-Band以上。(4)本技術製作方法簡易且可達到甚大之頻寬(BW = 80%)。(5)此新型電路亦可製作成傳統的表面聲波濾波器，具彈性便利。本發明正申請專利中。

聯絡人：洪茂峰，國立成功大學電機工程

系，(701)台南市大學路1號，電話：(06)2757575轉62342。

## 生物技術產業

### 對腦癌具有特殊活性之嘧啶類葉酸代謝拮抗劑

嘧啶類葉酸代謝拮抗劑Methotrexate長期用於抗腫瘤藥物、抗風濕、抗牛皮癬以及治療AIDS病人常見之*Pneumocystis carinii*感染併發肺炎。然而該藥物存在著抗藥性的問題，原因在於負責輸送該藥物進入細胞之葉酸運輸蛋白(folate transporter)產生變異，或由於作用酵素發生變異，以致對該藥物之敏感度降低。

核糖核酸製造過程中，酵素thymidylate synthetase是嘌呤生合成的關鍵步驟，以四羥葉酸(N5,N10-methenyltetrahydrofolic acid, MTHF)作為單碳移轉反應之輔助因子(cofactor for one-carbon-unit transfer reaction)，而酵素glycinamide ribonucleotide transformylase (GARTFase)及aminoimidazolecarboxamide ribonucleotide transformylase (AICARTFase)則是嘌呤生合成之關鍵步驟，這些步驟亦以四羥葉酸代謝物作為輔助因子。通常癌細胞核糖核酸的生合成速率高於正常細胞，因此這些關鍵酵素已成為設計抗癌新藥物之重要標的。

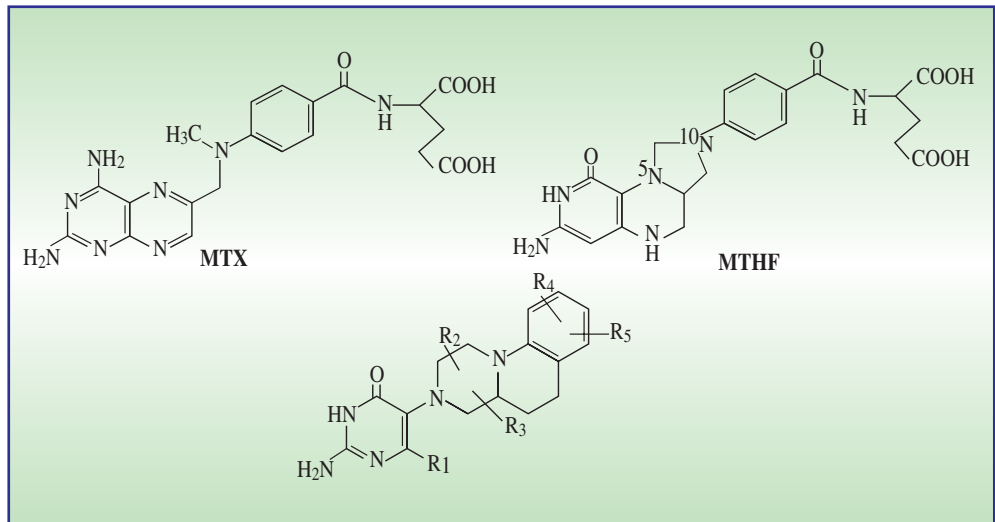
本發明之原理係設計一系列2-胺基-6-甲基-5-(4-取代-1-六氫嘧啶)嘧啶-4-(3H)-酮基化合物，作為具有開環結構之MTHF類似物。該類化合物有近似於MTHF之空間配置(spacial orientation)，特點在於其單環結構造成之親脂性(lipophilicity)可能促使其被動運輸進入細胞發揮藥效，擺脫methotrexate等舊藥需靠葉酸輸送蛋白(folate transporter)運輸而產生的抗藥性問題。再者，單環構型形成之結構彈性亦可能提高該類藥物進入標的酵素活化區(active site)的機會，而發揮抑制酵素的作用。

本發明藥物經美國國家癌症研究中心篩選，證實對人類腦癌細胞具有相當活性。13個測試藥物中之5個藥物(compounds 7, 8, 9, 10 and 12)對



該腦癌細胞造成50%生長抑制的藥物濃度(GI<sub>50</sub>)在1.39×10<sup>-7</sup> M至10<sup>-8</sup> M之間。由於腦部結構特殊，大多數藥物不易進入腦部，致臨床上治療腦癌之藥物不多。本發明之嘧啶類藥物具有親脂特性，容易穿透細胞，對腦癌具有特殊活性，因此具有一定的重要性及經濟效益。該發明之創新性及產業實用性獲得新藥、新製程及新用法的1997年美國專利(US Patent No. 5670508)及2001年中華民國專利(公告號424090)。

聯絡人：王惠珀，行政院衛生署藥政處，(100)台北市愛國東路100號11樓，電話：(02)23210151轉391。



MTHF及MTX開環式衍生物作為抗癌藥物

似，但是以蛋白質為探針，用來檢測蛋白質。

我們設計的螢光生物晶片系統(Phosphor-Biochip)，是一項新穎的生物晶片系統。運用螢光阻斷技術(Phosphor-Cutting Technology)，利用具螢光標籤(Luminescent Label)的螢光阻斷分子(Phosphor-Cutting Molecule一種有機金屬螢光體，也可用在OLED顯示器)，對DNA進行選擇性結合(Binding)並阻斷(Cutting)。阻斷分子上的螢光標籤，在與特定的DNA片段結合之後，螢光會發生可觀測的變化。這種具選擇性的變化，可以顯示特定的DNA片段的的存在。主要的應用包括：DNA診斷或修復、基因解碼以及疾病篩檢、新藥開發、遺傳病學研究等等。其主要作用原理如下圖所示：

如欲合作開發、專利授權或需更多資料請洽聯絡人：高逢時，淡江大學化學系，(251)淡水郵政1-166號信箱，電話：0958-055-770，電子信箱：biosearch@hotmail.com。

## 生物技術產業

### 新穎螢光生物晶片(Phosphor-Biochip)

廣義地說，生物晶片是指在玻璃、塑膠、高分子或矽基材上，以生物化學反應原理，利用微機電及微製程等精密技術，製成應用於生物檢測、分析、實驗的高科技晶片；目前仍處於初期發展階段。依照其特性，生物晶片大概可分為以下三種：

#### 1. DNA 晶片(DNA Chip)：

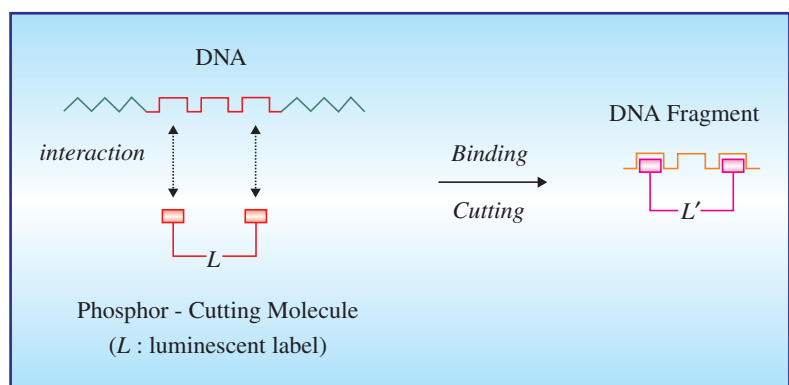
在載板上安置DNA片段；利用DNA的雜交反應特性(Hybridization)，來達到辨識DNA的目的。目前國內研發的生物晶片，大多是這類晶片。

#### 2. 程序晶片(Processing Chip)：

利用微機電及微製程等技術，將實驗環境及實驗程序微縮於晶片上，在晶片上進行相關實驗。

#### 3. 蛋白質晶片(Protein Chip)：

蛋白質晶片原理與DNA晶片相



## Communication Industry

### Chip Antenna

In wireless communication system, the antenna is an important component using to transmit and receive signals. In order to meet the demands for the future wireless communication devices that are lighter, thinner, and smaller, chip antennas have been developed to replace the conventional wire (or helical) antennas. However, it is very difficult to obtain a chip antenna with small size and large bandwidth at the same time. The invention presents a new structure of chip antenna that results in size reduction and bandwidth expansion (Fig. 1).

The chip antenna has a substrate of a dielectric material and one or more layers, and a feeding pad formed on an outer surface of the substrate for signal injection. In particular, a meandering conductor is disposed on at least one layer of the substrate for use as a radiator unit. A conductor is disposed on a substrate layer for use as a feeding conductor for the antenna, and for propagating signals when connected to a signal source. A matching unit disposed on the layers of substrate includes a matching conductor and a ground in which the matching conductor is shielded by at least one plate of the ground. In particular, portions of the matching conductor are respectively connected to the meandering conductor, ground, and feeding conductor. The matching unit improves the chip antenna's input impedance so that the bandwidth of the chip antenna can be extended. Figure 2 shows an embodied chip antenna operating at 2.4 GHz band (ISM band).

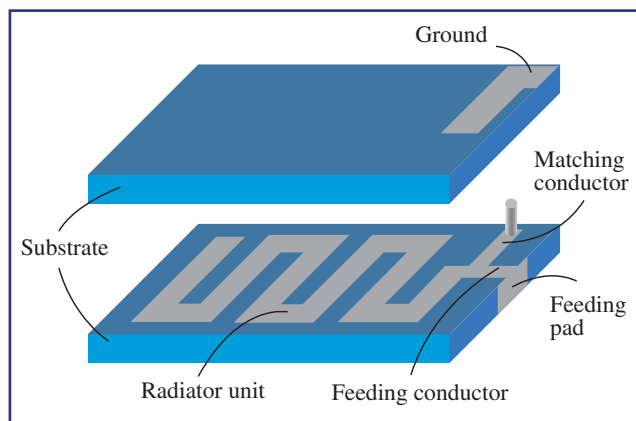


Fig. 1 Schematic structure of the chip antenna.

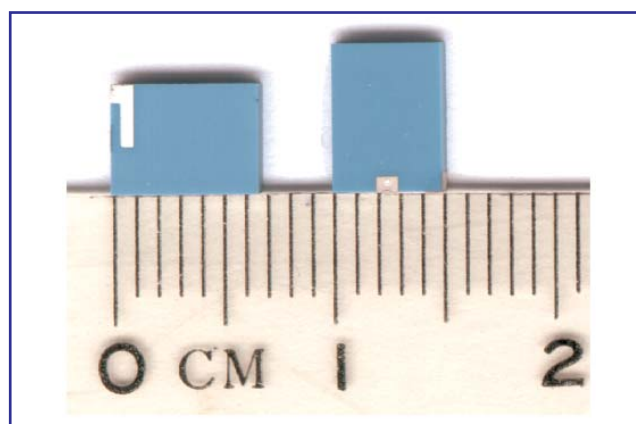


Fig. 2 A chip antenna operates at 2.4 GHz band.

### In This Issue

- Chip Antenna
- High-Breakdown Voltage Heterostructure Field-Effect Transistor for High Temperature Operations
- Gigahertz-Band Low-Loss Wide Bandwidth Novel Surface Acoustic Wave Filter by Using Simple Fabricated Processes
- Novel Lipophilic Folate Antimetabolites as Anticancer Agents for Brain Tumor
- Novel Phosphor-Biochip

The chip antenna of the present invention possesses the advantages of small size, large bandwidth, and high reliability. It is well suited for short-range wireless communication applications, e.g. bluetooth module and wireless LAN.

The developers wish to cooperate with qualified domestic and overseas manufacturer. (ROC Patent No.452996)

For further information, please contact Wen-Jen Tseng, Jyh-Wen Sheen, Jian-Hong Chen and Jackie Shue, Computer & Communications Research Laboratories, Industrial Technology Research Institute, Hsinchu, Taiwan, ROC. Tel: 886-3-5732124, 886-3-5917613.

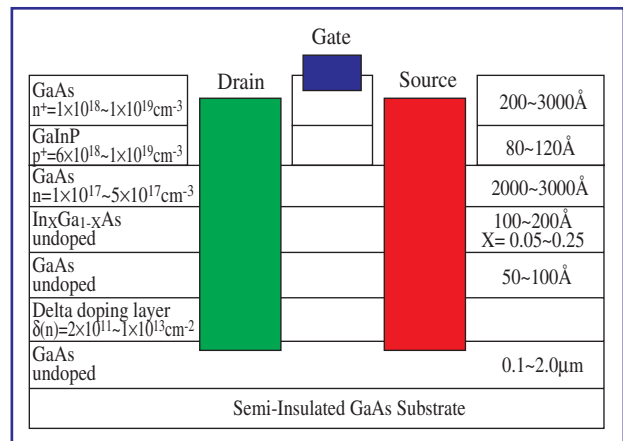


Fig. 1 The schematic cross section of the device.

## Integrated Circuit Industry

### High-Breakdown Voltage Heterostructure Field-Effect Transistor for High Temperature Operations

Recently, high speed, microwave, and power electronic components fabricated by compound semiconductor have paid an important role in the electronic field. Many field effect transistors (FETs) must be permanently operated in high temperature environments have been widely applied in the electronic equipments, such as space explore, satellite technology, automatic control, navigation, radar, and the investigation below the ground, etc. However, as the device dimension is reduced, the distance between electrodes is also decreased. This causes the reduction of breakdown voltage attributed from high field between drain and source regime. In high temperature environments, the gate potential barrier height of FETs is reduced as temperature increases. Furthermore, substrate leakage current could reduce the breakdown voltage and degrade the device performance in high-temperature environments.

In this invention, we propose and develop a high-breakdown voltage heterostructure FET suitable for high-temperature operations. Due the use of n<sup>+</sup>-GaAs/p<sup>+</sup>-InGaP/n<sup>-</sup>-GaAs gate structure, electrons can be effectively confined in the channel because of the presence of significant conduction- and valance-band discontinuities at GaInP/GaAs heterointerface. Thus, device performances with high transconductance, high breakdown voltage, and low gate leakage current can be achieved, simultaneously. In addition, the sub-channel is designed as an InGaAs layer. A quantum-well channel structure is formed due to the employment of GaAs/In<sub>0.15</sub>Ga<sub>0.85</sub>As/GaAs structure. Hence the confinement of electrons and linearity performance of the device can be improved.

Furthermore, the carrier supplier is an inverted δ-doped sheet. This provides the good properties of higher electron concentration, higher electron mobility and lower impurity scattering effect. Based on these advantages, we believe that this invention can be applied to the fabrication of high-performance FETs. Moreover, it will play an important role in the applications of the high-frequency microwave circuits. (ROC Patent No. 452978)

The developer wishes to cooperate with qualified manufacturer. Someone who is interested with this invention is very welcome to cooperate with us.

For further information, write or call, Wen-Chau Liu or Jung-Hui Tsai or Wen-Lung Chang or Kuo-Hui Yu or Kun-Wei Lin, Department of Electrical Engineering and Institute of Microelectronics, National Cheng Kung University, Tainan, Taiwan, ROC. Tel: 886-2-2757575 ext. 62354.

## Electronics Industry

### Gigahertz-Band Low-Loss Wide Bandwidth Novel Surface Acoustic Wave Filter by Using Simple Fabricated Processes

The inventive technologies were based on the relative principles of the surface acoustic wave. By using properly coupling circuit design, the GHz-Band novel SAW filter with a bandwidth as wide as 800 MHz (BW=80%), and an insertion loss as low as -2.962 dB was achieved. This characteristic results from the interaction of the wave. It makes the central frequency and bandwidth of our SAW filter be growth by the parameters effect and also reduce the insertion loss at the same time. If we apply this technology to the high frequency operation, it can also support more

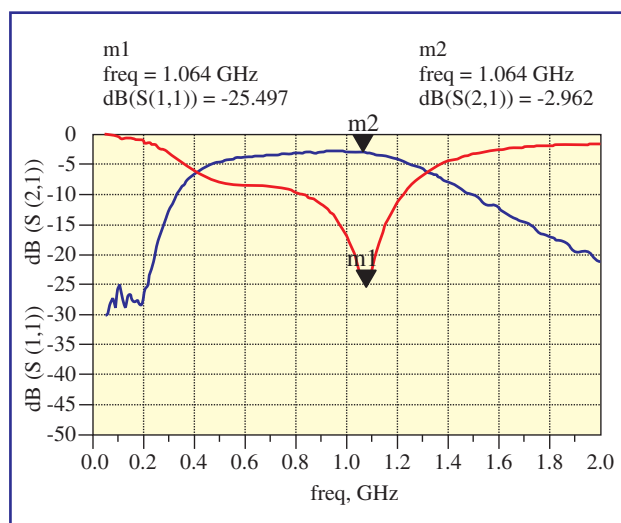


Fig. 1 The frequency response of the novel circuit SAW filter which was fabricated on  $128^\circ$ -rotated YX  $\text{LiNbO}_3$  substrate. (including 42-pair  $16\ \mu\text{m}$  IDT)

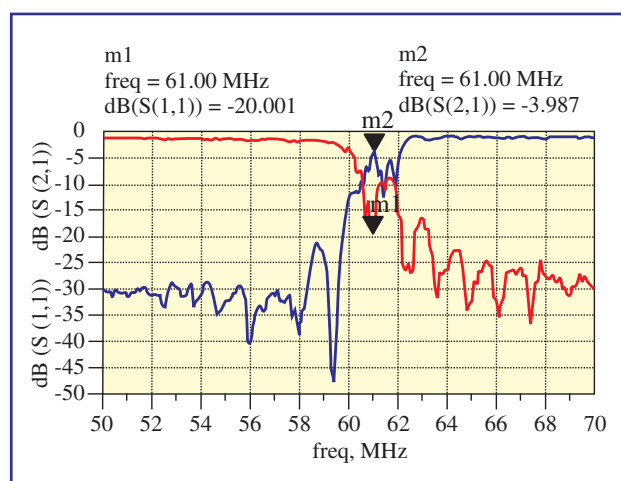


Fig. 2 The frequency response of the conventional SAW filter which was fabricated on  $128^\circ$ -rotated YX  $\text{LiNbO}_3$  substrate with the novel circuit. (42-pair  $16\ \mu\text{m}$  IDT)

excellent filter function and wider frequency range to the classic SAW device. Due to the technology, we do not need to reduce the size of the IDT finger width and can effectively improve the central frequency to the GHz. The frequency response of the novel circuit SAW filter which was fabricated on  $128^\circ$ -rotated YX  $\text{LiNbO}_3$  substrate. (including 42-pair  $16\ \mu\text{m}$  IDT), as shown in Fig. 1. The frequency response of the conventional SAW filter which was fabricated on  $128^\circ$ -rotated YX  $\text{LiNbO}_3$  substrate with the novel circuit. (42-pair  $16\ \mu\text{m}$  IDT), as shown in Fig. 2.

The developed novel SAW filter has the following advantages: (1) We just need one photomask in processes. It is easily fabricated and

suitable for mass production in industry. (2) Because of the novel filter manufactured by the parameter effect, we can improve the detriments of the conventional SAW device and effectively reduce the insertion loss into 3dB. (3) The central frequency raises to GHz-Band effectively. (4) This technology is easily fabricated and can perform large bandwidth. (BW=80%) (5) The novel circuit can also be fabricated to conventional SAW filter. It gets us more flexibility and convenient.

For more information, please contact with Mau-Phon Houg, Department of Electrical Engineering, National Cheng Kung University, Tainan, Taiwan, ROC. Tel: 886-6- 2757575 ext. 62342.

## Biotechnology Industry

### Novel Lipophilic Folate Antimetabolites as Anticancer Agents for Brain Tumor

Methotrexate, a folate antimetabolite, has been intensively used in the treatment of cancer, rheumatoid arthritis, psoriasis, and *Pneumocystis carinii* caused pneumonia commonly associated with AIDS patients. However, problem of drug resistance emerged as one of the unfavorable characteristics of this folate antimetabolite. The acquired drug resistance is either due to an impaired folate transporter-mediated process on cellular uptake or an alteration of its target enzyme, such as dihydrofolate reductase (DHFR) or thymidylate synthetase along DNA biosynthetic pathway.

In consideration of drugs with better cellular uptake via passive diffusion leading to higher intracellular bioavailability and more structural flexibility for reaching the active site of the target enzyme, we designed and prepared a series of 2-amino-6-methyl-5-(4-substituted-1-piperaziny) pyrimidin-4(3H)-ones as open-ring analogues of methotrexate. The compounds, structurally similar to the open-ring analogues of methylenetetrahydrofolate (MTHF), are also potential inhibitors of glycinamide ribonucleotide transformylase (GARTFase) and aminoimidazolecarboxamide ribonucleotide transformylase (AICARTFase), the key enzymes for purine biosynthesis. The significance of structural design on these compounds is (1) being lipophilic for the improvement of cellular uptake; (2) maintaining the core 2-aminopyrimidin-4(3H)-one skeleton and (3) using piperazine as a bridge to maintain four-atom distance from the pyrimidine ring to the phenyl ring so as to keep the molecules conformationally similar to that of methotrexate (Fig. 1). Antitumor screening was conducted on 60 disease-oriented human cancer cell lines by the National Cancer Institute (NCI) of the



U.S.A. Five (compounds **7**, **8**, **9**, **10** and **12**) out of thirteen compounds tested showed selective cytotoxicity on SNB75 human CNS tumor cell line with  $GI_{50}$ , represents the concentration corresponding to 50% of growth inhibition, ranged from  $1.39 \times 10^{-7}$  M to less than  $10^{-8}$  M. The opening analogues seemed to provide better lipophilicity for the improvement on cellular uptake. In comparison with the rigid structure of methotrexate MTHF, the conformational flexibility of these opening analogues might count for their accessibility to the target enzyme.

For further information, please contact Hui-po Wang, Director General, Bureau of Pharmaceutical Affairs, Department of Health, Taipei, Taiwan, ROC. Tel: 886-2-23210151 ext. 391.

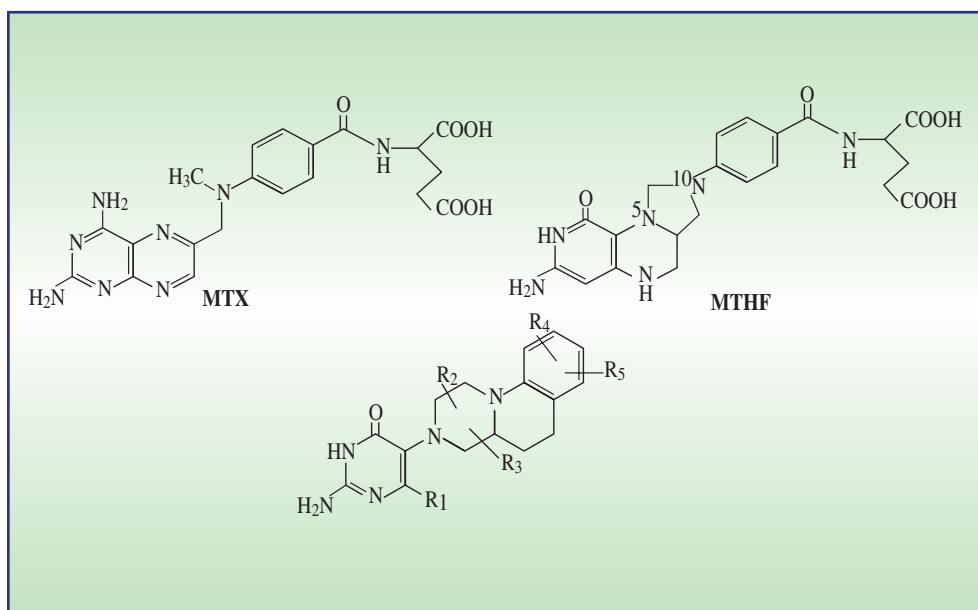


Fig. 1 Opening analogues of MTHF as antitumor agents.

## Biotechnology Industry

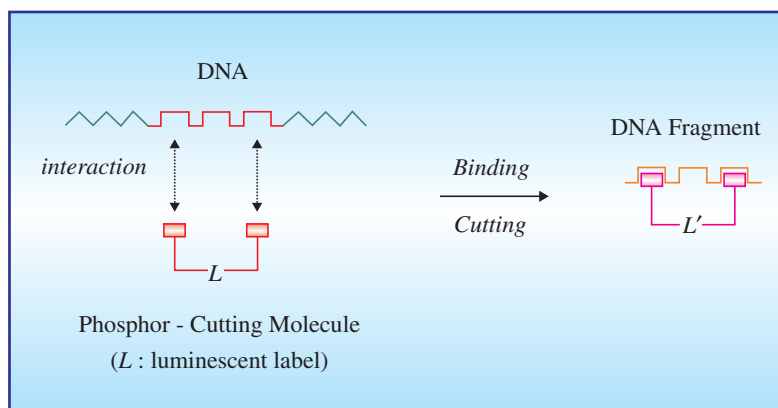
### Novel Phosphor-Biochip

“Biochip” usually refers to a series of products due to the variety of biochemical assays that are manufactured for applications in life science, including medical diagnostics, drug discovery, environmental restoration and agriculture. Biochip is a powerful tool to study the biomolecule basis of interaction and reveals huge amount of information on a scale that is not possible using conventional methods. The field of biochip technology has evolved over the past quarter of a century. There are many types of biochip for various applications, for instance, DNA chip, RNA chip, protein chip, etc. For its simplicity, efficiency and low cost, the development of biochip will be limited to infinite.

The system of “Phosphor-Biochip” is a newly developed aspect of

biochip. The probe “Phosphor-Cutting Molecule” (organometallic phosphors which could also be used in OLED displays) was designed for this “Phosphor-Biochip”. These molecules exhibit function of DNA recognition and are capable of specifically binding and cleavage of DNA. The emission color of the luminescent label on the molecules before and after reacts with DNA will be obviously changed. In this way, the specialized luminescence can be related to the presence of certain DNA fragment and thus the chip can be applied on the diagnosis of DNA, gene sequencing, etc. A schematic description is as below:

For more information, please contact Dr. Feng-Shih Kao, Department of Chemistry, Tamkang University, Tamshui, Taipei County, Taiwan, ROC. Tel : 886-958-055-770, E-mail: biosearch@hotmail.com.





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